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DIVISION OF ADMINISTRATIVE OFFICERS OF ENGINEERING COLLEGES, SEMI-ANNUAL REPORT. *A. A. Potter* 311

A CALL TO THE SECTIONS AND BRANCHES. *H. M. Crothers, Vice President* 316

ENGINEERING EDUCATION APPROACHES A CROSSROADS. *L. E. Grinter* ... 318

THE PHOENIX—A CHALLENGE TO ENGINEERING EDUCATION. *W. L. Everitt* 321

BRITISH THINKING ON ENGINEERING ECONOMY. *R. C. Putnam* 329

DISCUSSION OF REPORT ON ENGINEERING EDUCATION AFTER THE WAR. *H. J. Gilkey* 332

NECROLOGY:

Charles Felton Scott 345

Edward Franklin Berry 346

NEW MEMBERS 347

ITEMS OF INTEREST 349

SECTIONS, BRANCHES AND DIVISIONS 350

COLLEGE NOTES 359

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Division of Administrative Officers of Engineering Colleges S.P.E.E.

Semi-Annual Report

By A. A. POTTER, *Chairman*

Principal Administrative Officers were advised regarding public questions of interest to their institutions through letters by the Chairman of the Division dated July 15, September 11, October 9, November 6, and December 27, 1944.

The letter of July 15, 1944 reported a meeting held in Washington on July 13, 1944, between the Members of the Executive Committee and the Administration of Veterans Affairs. The general problems of the relationship of the engineering colleges to veterans' training, both under Public Laws 16 and 346 were discussed and the following details as to procedures and practices, which were elaborated, are submitted for the information of engineering colleges:

(1) Screening and counselling services have been and will be set up for disabled veterans under Public Law 16. These services may be utilized by veterans coming under Public Law 346 (G.I. Bill). Veterans under Public Law 346 are not required to utilize the screening and counselling services, but may apply directly to institutions for admission. (See Veterans Administration Service Letter, dated July 1, 1944, Item 10B.)

(2) The Veterans Administration operates through regional offices. A list of such offices and the names of their managers (Bulletin No. 1–K) was sent to the principal administrative officers of engineering colleges, as well as a copy of the Service Letter referred to above.

(3) The Veterans Administration does not itself expect, and will not ask institutions, to set up special programs for veterans. Those in charge of veterans affairs are convinced that the veteran will be better served by the regularly established and proved collegiate programs leading to degrees.

Public Law 346, paragraph 3, page 6 reads as follows:

> 3. Such person shall be eligible for and entitled to such course of education or training as he may elect, and at any approved educational or training institution at which he chooses to enroll, whether or not located in the State in which he resides, which will accept or retain him as a student or trainee in any field or branch of knowledge which such institution finds him qualified to undertake or pursue: *Provided*, That, for reasons satisfactory to the Administrator he may change a course of instruction: *And provided further*, That, any such course of education or training may be discontinued at any time, if it is found by the Administrator that, according to the regularly prescribed standards and practices of the institution, the conduct or progress of such person is unsatisfactory.

(4) The Governors of the States have been requested to send to the Administrator a list of approved institutions. In order to aid the Administrator in his appraisals of engineering colleges, a list of institutions approved by E.C.P.D. was mailed to the Administrator.

(5) Institutions are expected to maintain their established admission and graduation standards. It is expected that there will be no difference in the treatment and privileges accorded veterans and other collegiate students.

(6) Unless the fees and tuition charged to veterans are different from those published, no special contracts are contemplated.

(7) Veterans qualified, under the Act, may pursue programs of study on the graduate as well as on the undergraduate level.

(8) Employed veterans may pursue evening or other part time courses under limited subsistence benefits, but with full payment of tuition and other educational expenses.

The cordial reception accorded your executive Committee by General Hines and his staff was appreciated and it was gratifying to find that his views about engineering education coincided with those of the Committee.

Two letters were mailed on September 11, 1944. One outlined the program for the Chicago Meeting of the Division on October 23, 1944. The second letter reported that the Society for the Promotion of Engineering Education was represented by its President and two members of the Executive Committee of the Administrative Division at a conference on pending federal educational legislation called by the U. S. Commissioner of Education in Washington, August 10 and 11, 1944. Ten other educational associations were in attendance at this conference, the S.P.E.E. being the only group representing higher education of a professional character. The discussions at this conference resulted in general agreement regarding the following matters:

1. Grant-in-aid by the Federal Government to the States or institutions within the States should meet one or more of the following requirements:

(a) Necessary to carrying on a primary function of the National Government, such as R.O.T.C. or agricultural research;

(b) Necessary to equalize fundamentals of educational offerings to childhood and youth irrespective of wealth, geographic location or physical handicap;

(c) Necessary to stimulate action or participation in desirable social or economic measures, such as vocational education, physical and health education;

(d) Necessary to meet unusual emergencies such as teacher shortage due to war conditions or war expansion in industry.

2. All Federal funds for education should be distributed through the duly constituted authorities at the respective levels and should avoid changes in state controls and supervision of education.

3. Federal funds should be made for stated periods, should be re-studied near the end of the period, and should cease when the specific need no longer exists.

4. The Conference recommended to the American Vocational Association that for the phrase "less than college grade" there be substituted "and/or vocational and technical education pri-

marily terminal in nature and of secondary level including grades 13 and 14." It was also suggested that the Commissioner of Education be advised to substitute for the present definition of "less than college grade," which is defined as relating to a program where "college entrance requirements are not made prerequisites for admission, and where the training program does not lead to a degree" to the following: 'When the skills and technical knowledge necessary to enter an occupational field or to hold a place in an occupational field do not involve the organized courses in physical science and mathematics which are necessary for the successful completion of a college course, and where the instruction in the physical sciences and mathematics given in the vocational program are those necessary to make effective use of the skills involved."

The letter of October 9, 1944 included additional information regarding the October 23, 1944 meeting of the Division.

The Chicago meeting of the Division on October 23, 1944 was attended by about one hundred and fifty principal administrative officers and staff members of engineering colleges. The major discussions at this conference were:

Ernest R. Breech, President of Bendix Aviation Corporation, discussed "Surplus Aircraft—An Asset or a Liability." Those in attendance were given a printed leaflet which covered the main features of Mr. Breech's talk. Dean MacQuigg of Ohio State University, Chairman of the Surplus Government Property Committee of the Division led in the discussion in which Henry H. Armsby of the U. S. Office of Education, Dean LaSalle of the University of Louisiana, Dean Langsdorf of Washington University, St. Louis, Dean Butler of the University of Arizona, President Wickenden of Case School of Applied Science, Dean Steinberg of the University of Maryland and several others took part.

The Engineering College Research Association and Research Legislation were discussed by Dean W. R. Woolrich, President of the Engineering College Research Association and Dean Saville of New York University.

The Status of Engineering Extension Legislation was presented in a paper by Professor J. O. Keller of the Pennsylvania State College.

The discussion of "Pressures for Functional Courses" was led by Director Hammond of the Pennsylvania State College and followed by Dean Hollister of Cornell, Dean Freund of Detroit, President Van Leer of the Georgia School of Technology, Dean O'Brien of the University of California, Dean Dudley of Yale, Dean Dirkes of Michigan, Director Keller of Pennsylvania State.

President Van Leer of the Georgia School of Technology brought the conference up to date with the Army's attitudes regarding Universal Military Training. This subject was discussed by Dean Hollister of Cornell, Dean Lind of Minnesota, Mr. Fletcher of the Caterpillar Tractor Company, Dean Grinter of the Illinois Institute of Technology, Dean Freund of Detroit University, and several others.

The last paper of the conference by Dean Steinberg of the University of Maryland was concerned with "International Relations Involving the Training of Students from Foreign Lands." This paper was the result of contacts by Dean Steinberg with different agencies of the Government and will result in keeping the Engineering Colleges

fully informed about opportunities which may be afforded this country to aid in educating the engineers of other lands.

With the communication of November 6, 1944 a statement of the Present Status of Surplus Government Property was included as well as the following additional information regarding the rulings of the Veterans Administration:

1. The "ordinary school year" is defined as a period of two semesters or three quarters—not less than thirty nor more than thirty-eight weeks in total length. Under this definition an institution may be paid as much as five hundred dollars for each "ordinary school year" which is completed regardless of the time required for such completion. Thus up to two thousand dollars may be paid for eight fifteen week terms which are completed within three calendar years.

2. Veterans who receive earnings while pursuing training are not necessarily deprived of the payment of pension or subsistence.

3. Veterans carrying twelve semester hours are entitled to full subsistence. Those carrying six to nine hours receive half subsistence.

4. Educational institutions are advised to give special consideration to suitable housing for married veterans who will receive the benefits of Public Laws 16 or 346.

On December 27, 1944 the Principal Administration Officers of Engineering Colleges were advised about conferences which were held in Washington by the Members of the Executive Committee of the Division, accompanied by the President of the Society and Dr. W. E. Wickenden of Case School of Applied Science. Mainly this communication was concerned with a very satisfactory conference which was held with Vice Admiral Randall Jacobs, U. S. N., Chief of Naval Personnel, and his staff, at which Dr. Joseph W. Barker, Special Assistant to the Secretary of the Navy was present.

A continuous twelve month period of universal military training service is regarded as essential to national security by the armed forces and that this view is being supported by some of the executive agencies of the Government. Certain fundamental policies seem to be guiding the planning for the year of universal military training. These are interpreted to include among other matters, the following:

1. The young men in the Universal Military Training Program will be assigned either to the Army or to the Navy, the ratio for the two armed services being about eight to three.

2. Trainees will be inducted at quarterly intervals, in approximately equal increments, after completion of secondary school education, following the seventeenth and before the twenty-first birthday, in order to utilize the training facilities most efficiently.

3. The groups in training in the Army and Navy will be distinct from the active forces of the armed military services, and will not be eligible for service in ordinary military operations, except as may be determined by Congress. Special units of the armed forces will be charged with the responsibility for this type of training.

4. It appears that the Navy program will cover four phases, as follows:

(a) Recruit, or boot training.

(b) Class A School, or vocational training for a particular rating, such as electrician's mate, machinist-mate, or radar technician.

(c) Pre-commission, which involves nucleus crew training.

(d) Operational training aboard ship.

5. The Navy proposes to establish additional Naval R.O.T.C. Units, as indicated in Senate Bill 2195. Some of the present V–12 institutions will be utilized.

Entrance into N.R.O.T.C. Units and into the Naval Academy at Annapolis will be after completion of one year of Universal Military Training.

Screening of eligibles for admission to the Naval R.O.T.C. may be made during the year of Universal Military Training and final selection may be made by Boards, consisting of Naval, business and educational members.

Candidates may indicate their choices of institutions and curricula, but will be assigned by the Naval authorities in accordance with established quotas.

It seems apparent that the Navy will prescribe for those enrolled in N.R.O.T.C. Units a certain nulceus of subjects which have naval implications, but the greater part of which can be intergrated into an ordinary engineering curriculum.

If the U.M.T. program is adopted, trainees will be inducted and graduated quarterly. Admission to N.R.O.T.C. in colleges is then expected to take place in accordance with the normal institutional calendar.

It is likewise then expected that colleges and universities will operate the N.R.O.T.C. on their usual academic calendars; that is, either on the semester, quarter or trimester plan. Those choosing N.R.O.T.C. will be permitted to remain until graduation if successful in all subjects. Compensation for reserve officer training in colleges and universities must be determined by an Act of Congress, as a part of the general plan. Your Committee is highly gratified to note the disposition of the Navy to consult with representatives of engineering colleges in formulating its reserve officer corps (N.R.O.T.C.) program.

During the past six months three meetings of the Executive Committee of the Division were held. In addition Sub-committees of the Executive Committee of the Division have been in close contact with governmental and other agencies in Washington.

Realizing that the problems of engineering college staffs differ greatly from those of other academic staffs, with reference to salary, tenure and professional practice, and after consultation with the President of the Society, a Committee of the Division of Administrative Officers was set up on Academic Tenure, Professional Service and Responsibility. It is hoped that this Committee will be able to report at the June meeting of the Society.

A Call to the Sections and Branches

By H. M. CROTHERS

Vice President of the Society and Chairman, Committee on Sections and Branches

The 1944 Report on Engineering Education After the War is an excellent outline of work to be done. It is a first step. The fact that it has been made so thoughtfully and that it has been received with such obvious approval by the Society should be very encouraging, but the fact remains that other steps are necessary. The report provides clear statements of purposes and problems, and it defines important objectives, but to meet these problems and to achieve these objectives requires further effort. In the language of the report "It remains for the great body of those who conduct engineering education . . . to take action."

If the recommendations are to be converted into practice, it must be in the individual class room, and through the coöperative efforts between teachers and between departments in each institution. Each institution and each area has its local conditions to which the general statements must be adapted before they can be most useful. Local study and local discussion must precede local action to make such action most effective.

The sections and branches are the units of the Society which are concerned with local study and discussion. In our democratic organization they have the responsibility for such efforts and they largely determine what the final results will be. Their coöperation in attaining the objectives set out in this report has been solicited.

The problems for discussion are so numerous and varied that some selection and orderly plan of attack is required. Work for special committees may be indicated. At the present stages the humanistic-social stem may be causing more perplexity than the scientific-technological stem. The following questions illustrate the perplexity of one individual, a perplexity that might be dissipated by hearing the views of others.

For the humanistic-social stem a number of objectives are stated and each is recognized as important. Do these cover more than can be fully accomplished in the time available and at the average state of maturity of our graduating classes? If so, in which should we strive for full accomplishment by graduation time and in which must we be content to sow the seeds, hoping for later development? Each teacher has experiences and observations to draw on in reaching some conclusion. How do these conclusions agree locally and what shall be the basis for local action?

We recognize the main problem as one of broadening both the interests and the background of engineering students so that these include social sciences as well as the physical sciences. Is it fair to say that past efforts have generally resulted in more background than interest, and therefore, not a great deal of either? To a large extent, in-

terest and knowledge must develop together if either is to progress very far but it is true that knowledge and understanding are acquired much more rapidly if an active interest supplies the motive. To what extent and by what means may engineering teachers do more to arouse such interests in the social sciences? Their past efforts and experiences suggest partial answers and collectively may supply the most satisfactory answer.

First and foremost, example is the most powerful agency. Engineering students do accept guidance in their interests and activities, especially by example, but they have their own rating scheme as to sources. Generally speaking, practicing engineers rate the highest, engineering teachers next, and teachers of social sciences somewhat lower. Obviously it is not fair to expect the teachers of social sciences to bear the full burden of arousing the interest of engineering students in the social science fields. The social science teachers must conduct their courses so as to nurture any interests that exist, but they labor under adverse conditions unless the engineering students are fully aware that practising engineers and engineering teachers have active interests in these same fields. Engineering teachers can and do make the students aware of such interests by proper use of the excellent papers or activities of engineers relating to civic responsibility, economic problems, social institutions, and the relation of each of these to engineering. How much can the effectiveness of such efforts be increased in each institution? How much can each engineering teacher accomplish in the desired direction by careful thought as to his own attitude and influence?

A second thought that has been subjected to some trial is that the gap between engineering and the social sciences may be bridged for students of engineering by a course skillfully designed and conducted in industrial history, or some similar subject in which engineering and technical industry on the one hand develop close relations with economic affairs and social institutions on the other hand. Whether such a thought has merit for any institution may be decided by study and discussion of past experiences, or it may require further trial.

The scientific-technological stem of the curriculum has its problems just as numerous as the parallel stem. The allotment of time is not a new problem in the engineering fields, but the clearer definition of objectives should put this problem in a new light. The increased emphasis on basic principles is easier to prescribe than it is to practice. It takes careful and systematic thought on the part of text-book authors, teachers, and students to identify basic principles and methods as they are applied to specific problems, but doing this, or failing to do this, constitutes the difference between teaching sound methods of engineering analysis and teaching only methods of computation. There is room for much improvement in this respect and others. Local study and discussion should not be in vain.

The essence of the matter is that local study and discussion constitute the next step. A pooling of experiences and views is essential for effective local coöperation in action. Some sections and branches have already gone to work to make the most of this report for their own conditions. It is hoped that in spite of difficult war conditions other sections and branches will find it possible to take up similar studies.

Engineering Education Approaches a Crossroads

By L. E. GRINTER

Vice President and Dean of the Graduate School, Illinois Institute of Technology

With announcement of the adoption of five-year curricula in engineering by a leading private institution and of engineering faculty acceptance of the five-year plan by a leading state university, it is clearly time that we should reconsider our main objectives in engineering education. It would be tragic if the enthusiasm of the moment for professionalizing engineering education should cause us to lose sight of its usefulness as an education for living and for making a living in the twentieth century.

Through much of its history, but increasingly so since 1929, engineering education has been serving two basic purposes—training for entrance into the engineering profession and education for living in a technical world. And since living without the capacity to "make a living" is too idealistic for most young Americans, the ability of the engineer to be productive even in non-technical positions has rightly attracted our youth. The war has emphasized the importance of engineering and has interested great numbers of young men in technology as an outlet for their energies. With these influences coming to bear upon engineering education, it is inconceivable that we should shut the doors that we have worked so hard to open by widespread exclusive adoption of the five-year curriculum.

It is easy to fall into the mistaken belief that our students are universally destined to become professional engineers because they usually show enthusiasm for becoming members of the profession. However, if we realize that there are probably no more than 150,000 professional engineers in the United States (Government statistics indicate that only 275,000 persons claim the title), and that we will likely have an equal number of students enrolled in our engineering colleges after the war, it becomes clear that many are destined for positions in related fields. Such persons find the study of engineering vocationally helpful and intellectually stimulating.

No doubt there are good arguments for five years as a minimum period of education for the man who intends to serve through much of his lifetime as a professional engineer in the special fields of research and development. But operating engineers, production or construction men, and others whose interests and capacities are less scientific, seem to have received an adequate technical background through the usual accredited curricula. Most teachers appear to feel that the majority of our graduates have reached an educational plateau and that little would be accomplished by keeping them in college for another year. In reality, therefore, the usefulness of a five-year curriculum is limited to the training of the minority of scientific, intellectual

or ingenious students. For these our graduate schools already exist and we only need to lead these students, not to force them through its gates.

There has been poor leadership of the more intellectual or ingenious students in our undergraduate schools. How often have we advised a student to "Get a couple of years of practice before undertaking graduate study." This advice is clearly impractical since in two years he will usually be married and his chance for graduate study will have disappeared with his increase in responsibility. How seldom have we singled out the scientific or the ingenious student during his sophomore or junior year, given him special opportunities to develop his unique capacities for original work, and thus led him into graduate study by a series of easy steps. For such students we can thereby save a whole semester or perhaps in some cases a year of orientation in graduate study. No school is too poor or too understaffed to provide some leadership of this nature. Any institution that considers itself great must provide such direction for all of its intellectual or inventive students.

On the one hand, then, the individual treatment of our better students can supplant the need for a fixed five-year plan. On the other hand, there are those students who are interested in engineering either as training for the holding of a semi-technical managerial position or as a broad education that fortunately provides a reasonable earning capacity in our world today. Neither of these ideals is a cheap one —they are the same ideals held, but not usually expressed, by the liberal arts student. The fixed four-year curriculum has been reasonably acceptable to these young men but has not been as well fitted to their needs as they deserve. Since their lives will be spent in more intimate contact with people than is true of the professional engineer, they need a broader understanding of history, political and social science, economics, and management along with the ability to write and speak the English language well. It will be of benefit to society if we devote the additional time of about one semester to these studies, at the expense of a semester of technical work, for students having such general objectives.

What engineering education needs is not the greater rigidity of universal five-year curricula but greater flexibility. We should pick our scientific, intellectual, or ingenious students early, relieve them of considerable routine course work, and encourage their individual development by individual treatment. We should also extend an opportunity to that increasing group of students, whose interests either were never highly scientific or who find themselves without the ultimate desire to complete a professional curriculum, to obtain some designated degree in engineering with considerably increased work in non-engineering fields. For the remainder, who today constitute well over one-half of all engineering students, the present accredited curricula seem reasonably satisfactory.

As a final word, we must resist our tendency to believe that graduating student should know everything about several fields or even about one field of engineering. Why should electrical engineering education, for example, now encompass the study of electronics for all students? Let students have something to say about their own interests. All engineers need not be

specialists, some can be broadly trained; but some should be specialists because their inner desires are so intensely centered in one direction that we waste their time and ours by forcing them to study more than the minimum of work in general courses. We need many engineers who have a liberal education outside of the field of engineering, but we can use others effectively who have only the minimum training of this nature.

We should be proud to have produced a good man of any type—each man cannot be everything to everyone. It is inevitable that much of a man's education must be left to his adult years. Does it matter greatly which part? If the answer is no, I believe that it is most profitable to permit each individual to study those fields in college for which his mind is most receptive at that stage of his development. At least, this premise can with advantage be permitted to influence a minor part of the curriculum.

The Phoenix—A Challenge to Engineering Education

By W. L. EVERITT

Director of Operational Research, U. S. Signal Corps, on leave as Professor of Electrical Engineering, The Ohio State University

Foreword

This article is appearing simultaneously in the *Proceedings* of the Institute of Radio Engineers as part of a coördinated Institute program on education. The article was prepared to stimulate discussion by practicing engineers as well as teachers on the subject of engineering education after the war. To implement this discussion, the individual sections of the Institute, located in 27 cities, are planning to devote their November meeting to the subject of engineering education. At these meetings, a record will be kept of the most pertinent comments and the Education Committee of the Institute will digest these in a subsequent article. The discussions are not to be confined to the subject of *radio* engineering but will consider the broad general problems of education in which all engineers are interested. It is anticipated that, by such a program for a particular engineering society, the majority of whose members are practicing engineers, important contributions will be made to supplement the work of the various committees of the S.P.E.E. If the program is successful, it is hoped that other engineering societies may be induced to participate in similar examinations of the fundamental requirements for training to enter the profession.

Engineering education is at a crossroads. In this critical period when the manpower requirements of industry and the Armed Forces are necessarily draining current and potential students from our schools, we are presented with an opportunity never before available.

The development of engineering education has been an evolutionary process. It began to expand after the Morrill Land Grant Act of 1862, which provided for the foundation and maintenance of colleges "where the leading object was, without excluding other scientific and classical studies, to teach such branches of learning as are related to agriculture and the mechanic arts." Those who have followed the history of the beginning of the Land Grant colleges know that the conception of engineering as a profession was unknown at that time and there was much groping and experimentation in the teaching of the "Mechanic Arts."

While education in this field has been modified and expanded since that time, it is quite generally admitted that its growth has been much like that of Topsy. It has not itself been the subject of the engineering design processes which it claims to teach. Many of our plans and procedures of Engineering Education are haphazard, with-

out certain desirable objectives, and inadequate in scope and detail. Redefinition and modernization are required if mankind is to reap the tremendous benefits of sound engineering.

We find an inspiring concept in "the Phoenix" of Egyptian mythology, a bird consumed in fire by its own act, but which arose from the ashes in youthful freshness, more vigorous than ever. This concept implies that an essence of immortality is the ability to begin anew, combining the wisdom of age with the dynamic drive of youth.

Engineering education is now being burned by the fires of a technological war. Will it arise from the ashes, like the Phoenix of old, with a rejuvenation shown by its awareness of its opportunities, and the vigor to attack and solve its problems? Or will it simply continue on the path laid out by the old curricula and methods after a temporary recess? The choice is plain, and must be made by engineers and educators now, if a "Phoenix" is to be ready when the war is over.

The present interim is the golden opportunity for a real study of the basic problems of engineering education, and for the *design* of curricula. In peaceful years, there has been a resistance to change because of the problems of disturbing a smoothly moving process, and at times even because of the vested interests of departments and individuals who were teaching subjects in ways which they did not wish to see questioned. Furthermore changes in individual curricula would have reduced flexibility in the arranging of schedules of irregular students and transfers from institution to institution. But these and other objections to a basic study of the problem, and action thereon, do not apply today. Most of the upper-class engineering students in school at the time of Pearl Harbor were allowed to complete their college courses. After the war, a new crop of freshmen will enter and be carried forward. Now is the time for the engineering design of curricula in the several branches of professional engineering. In fact, if this opportunity is passed by we may not in our lifetime have another.

In order to carry on discussions of any problem, it is important that an agreement be reached among those concerned as to the subject of their discussion. Definitions are needed. The words *Science* and *Engineering* have so frequently been confused that it is believed essential that they should be distinguished, at least for the purpose of this discussion. Of late, there has been a particular tendency to imply that scientific and engineering education are one and the same thing. If this be so, then the engineering colleges have no justification for their existence and their duties should be absorbed by the appropriate basic science departments. The writer believes there is a definite and important difference, and furthermore that this difference has not been taken into account in the *evolutionary* development of engineering curricula.

Webster defines *Science* as "knowledge of principles or facts," or more specifically "accumulated and accepted knowledge which has been systematized and formulated with reference to the discovery of general truths or the operation of general laws."

Webster defines *Engineering* as the "art by which the properties of matter are made useful to man in structures and machines."

The most fundamental difference be-

tween Science and Engineering is the difference between *Analysis* and *Synthesis,* Science is interested primarily in learning what effects follow causes, in learning why and how nature, both physical and biological, behaves as it does, and in analyzing everything and finding out what to expect under a given set of conditions. Engineering, on the other hand, attempts something quite different. It is interested in assembling a combination of men and materials to produce a desired result or a reasonable facsimile thereof. This is the process of synthesis, of putting things together to accomplish a definite end.

The processes of synthesis can be accomplished only after a thorough grounding in the processes of analysis. One must know what results will follow from definite causes, both when they occur singly and when in combinations. But the methods of synthesis go beyond those of analysis and must be learned as such. Certain of these methods can be taught, but others involve judgment, the willingness to try, to recognize failures, and to try repeatedly, and some involve intuition. Their importance in engineering should be recognized and taken into account in the training of the engineer.

Synthesis inevitably requires more mature judgment than does analysis. Childhood is the time for taking clocks apart to find what makes them tick, but only the mentality of the adult can design an assembly of springs and gears to keep time within acceptable limits.

Engineering synthesis requires the use of a knowledge of more related elements while analysis can be broken down into isolated areas. The performance of a radio set can be analyzed without attention to economic factors; the design of such a set without considering economics, or the human use to which the set is to be put, is no design at all.

It is not meant that the work of the pure physicist is less important or less mature than that of the engineer. The pure physicist designs many ingenious devices to assist him in his work of analyzing nature. The cyclotron is a monumental work of synthesis. As such, it is essentially an engineering product, designed by physicists. But it is important to realize that the synthetic processes which physicists apply in research are not, in general, taught in the science classes. Applied physics is a form of engineering upon which the comments of this paper bear fully.

In our engineering curricula, we have taught the student almost exclusively the methods of analysis and very little of the methods of synthesis. He attends classes and laboratories and learns what happens when certain forces and materials are brought together. Very seldom does he have the opportunity to assemble, either on paper or in physical being, from out of all the world of nature at his disposal, a combination to produce a desired result. Engineering curricula have omitted instruction in "Engineering." As a result of this, our students go out as graduates, obtain a job, and then ask "Why wasn't I told about this thing called engineering before?" We have taught the engineer how his tools are put together, but generally we have not shown him how to use them.

Engineering is a way of life for those who pursue it, much more than a way of making a living. An engineer cannot be made by academic procedures alone, but these procedures should point the way from the beginning. Clear thinking should be an essential

in an engineering education and yet we have not been clear even in explaining to him what engineering is. Engineering is a dynamic force, it requires *doing* in order to exist, and it cannot be learned by passively studying what is already known, and stopping there. It is more than working the problems in the book, or ones like them with change only in constants. A real engineering problem always contains new elements, requires the production of a new result or device. It cannot be solved by routine application of rule-of-thumb methods. Although he depends greatly upon experience for his results, the engineer seldom repeats the work of the day before without modification.

A way of life must be inspired and cannot be taught by rote. Engineers, as a group, are generally recognized as having high ethical principles. However, we lose a golden opportunity in the engineering college if we do not point out to the student the need for high moral principles, and the inspiration which can be drawn in working both with the people and the laws of nature. We need also to point out the danger of a Frankenstein which can result from the improper application of engineering principles. We also need to be more articulate in the expression of the engineer's creed. We should have the equivalent of the Hippocratic oath which has inspired medical students for centuries.

Many people are called engineers who merely operate instruments, turn dials, or do other repetitive work. But such people are not engineers, even though they may have engineering degrees, and every effort should be made to make this clear to the public. In fact, engineering education should unfit a man for repetitive tasks, even though such tasks may require their performer to *know* a great deal.

The definition of engineering given by Webster included the phrase "made useful to man." This is extremely significant, as the engineer has not produced an engineering product unless it is useful to man. Therefore, the engineer should understand man as well as matter. He must learn how to recognize the needs of men, and how to interpret his material products to men so that men will use them. Hence, the curricula should include instruction which will help the young engineer to speak and write fluently and clearly. He must be able to convey his ideas to others. He should also be taught open-mindedness and given surveys of other fields of knowledge, present and past, so that he may understand and utilize the thoughts of others. He should be required to use these principles throughout his course in class recitations and in his written reports. The motto should be "learn and apply," not "study and forget."

It has frequently been assumed that courses in engineering curricula should be set up to teach *all* that the engineer should know about a given subject. But such an aim is futile, because of lack of time and because the instructor himself does not know everything. Furthermore, at the time he is a student, the art itself does not possess what the engineer will need to know ten years later. Therefore, the fundamental problem is to make the student *Literate* in the subject. He should have not only the *ability* to read and understand the literature and other available material on the subject, but also the desire to continue his reading or education in the field. Any educational course has failed completely if it does not so relate the material to the

man's life that he will be stimulated to continue to acquire knowledge in the subject and in turn apply it to his actions and decisions. The mental impressions received in a course where the student has the feeling at the end "Well, thank God that's over," will fade so rapidly that the course might better have been omitted. Engineering education should produce an educated man, and attainment of that objective requires not only good teaching but also a definite recognition of the goal and the integration of the whole educational program.

The processes of engineering, and synthesis in general, normally require the use of approximations. It is very seldom that an engineering product can be made to fit perfectly all the desirable criteria. If we try to make it fit too perfectly the most desirable objective, it may cost too much or be too difficult to run or maintain. Therefore, one of the most important decisions to be made is "how good is good enough." The engineering graduate too frequently does not realize this. The design of a $15 radio will, in general, require better engineering than that of a $500 one because it requires more judgment in eliminating the non-essential and making the most of the essential elements. And the design of the $15 radio may also be more "useful to man" because of its greater distribution. The engineer must be taught the utility of the imperfect, and the importance of the attainable and practical. Someone has said that an engineer is a man who can draw correct conclusions from incomplete and partly incorrect premises.

In teaching the importance of the practical, the engineer should learn not to waste his own efforts or those of his associates. If he is going to use resistors which are manufactured to tolerances $\pm$ 5 per cent, he should not make calculations to a large number of significant figures. On the other hand, if his answer depends upon the difference between two large numbers which are nearly equal, the calculations of the individual numbers must be very accurate in order to get a reasonable accuracy in their difference, and he should recognize when this is necessary. In the curricula, a studied effort should be made to introduce repeatedly situations where judgment is needed; the student should be graded on his performance, and should be advised on how to improve.

Special situations should be given where the student can use the principles of synthesis, starting with simple cases and proceeding to the more difficult. He should be taught how he can select from the complete world of data at his disposal those elements of importance to a particular problem. He should then be shown that synthesis in general uses the principle of educated guessing and checking of the results of the guess by analytical methods. The problem is somewhat similar to the mathematical one of integration, where the answer must be guessed (unless an old problem is recognized) and the analytical method of differentiation is available to find out whether the guess is correct.

Engineering schools should consider a greater use of the "case method" which has been adopted so widely for legal training. Certain types of problems can be used to illustrate the synthetic process. The author has found the design of an attenuation equalizer a good example. In this problem, a network is desired whose attenuation characteristic fits a particular curve. A table is consulted to find combina-

tions of resistances, inductances, and capacitors which have the general type of curve desired. Several may be available. The more complicated will, in general, cost more, both in time to design and money to manufacture. So we may try the simplest first. It may have two independent variables. We therefore select two points we shall try to fit exactly. This may be done by setting up two simultaneous equations. After we have fitted these two points, we then *analyze* the resulting network by computing its curve over the frequency range of interest. It will not fit the desired curve exactly but will be an approximation thereof. The designer must decide whether it is good enough. If it is not, he must try again, either by using two new points to fit or selecting a more complicated network which has more independent variables and so can be fitted at more points. In the end, he may have several solutions of different degrees of approximation and complexity (cost) and a decision must be made whether the better article is worth the extra cost. The complete plan of operation has most of the elements of engineering synthesis.

The purpose and conduct of laboratory courses should be examined carefully. To a large extent, the apparent aim of most educational laboratory experiments has been to verify that all the important statements in the book are really so. The same techniques are applied first on one piece of apparatus and then another to obtain curves which are already published. It is true that we should instill in our students a questioning mind that will not always accept the printed word as the gospel, but repetition in the methods of test may not always make the best use of the student's time. At least in the senior year, an opportunity should be given the student to design his own experiments, with only some general instruction such as "Find what the important characteristics of this machine age." Then he should be given some opportunity to design and assemble a working piece of apparatus to produce a desired result. Such a laboratory program would necessarily mean that he would not have the time to verify so many principles which have been taught but it would give him some experience in the engineering method of making tests and producing designs.

Training in the combination of analysis and synthesis required by the engineer necessarily takes an extended time. The completed education of the engineer involves both the period spent in the college and that spent in industry. Certain things can be taught best in the college, other things can be learned best in industry. Inevitably the job of the college will tend more toward the analysis which must be taught. Synthesis will be learned in industry. However, it would be surprising if the distribution of time decided on for the engineering curricula seventy or more years ago were the ideal today. Frequent suggestions have been made that the engineering curricula should be extended beyond four years. These suggestions have not been adopted because the *burden of proof* has been upon the colleges to show that more than four years would be advantageous to the individual and to industry in the completed training of the engineer, and this proof has *never been given* except in the case of men who intend to enter research in certain fields. Proper design procedure in the development of the curricula and a realistic recognition of

aims and possibilities should lead to a more definite answer.

It may be felt that because our existing curricula have trained men who have become good engineers, that no change should be considered. But this is the philosophy of "what was good enough for father is good enough for me" which is the very antithesis of the engineer's creed. As a matter of fact, we had engineers long before we had engineering education and we shall have engineering even though we do not teach it, because men will work out their own problems if the schools do not assist them. But unless the educational process itself is considered a failure, it seems evident that a properly designed curriculum will produce a better product.

The cultural value of the engineering way of thinking should not be overlooked in our post-war educational planning. The engineer has a way of life, a mental directness and vigor, which is useful in the solution of many of mankind's problems. The social scientist, the physician, the lawyer, the politician, the preacher, and many others can learn from him as well as teach him. However, in the past, when the student of arts has asked what course he might take to learn about engineers and engineering, we have offered him Elementary Surveying 301 or Direct Current Machinery 426. Such courses can never convey an idea of what engineers are or what they do. Is it any wonder our profession is misunderstood? We should give serious consideration to providing some such course as the "Philosophy and Methods of Engineering" for the cultural education of non-engineers. If our methods were known, workers in other fields could frequently frame their problems so they could be brought to engineers for solution and great additional good would result.

The design of engineering curricula should not be the job of educators alone, but should be participated in by practicing engineers of experience. In order to obtain such participation, an effective procedure is desirable. It is proposed that the individual sections of the Institute of Radio Engineers devote one meeting in the near future to a discussion of these problems. The representatives of the Institute at the educational institutions in the immediate vicinity of each section might act as a nucleus or committee to open the discussions. A secretary should be appointed for each section to record the significant comments and these should then be sent in to the Institute's committee on education for compilation. Then these assembled comments, the opinions of a representative group of engineers, could be made available to educators for consideration of any action which might be recommended.

The design of new curricula may require changes in methods of teaching, without which the desired results cannot be obtained. Serious study must be given to this problem as well as to the curricula content itself.

Conclusion

The design of individual curricula for Civil, Electrical, Radio, and other engineering branches will differ, and this article is not intended to suggest individual collections of courses. What is suggested is that engineering curricula should be *designed*. The engineering method of synthesis to produce the most desirable result from all the available material should be applied. This is a golden opportunity for educators and engineers to get together to

discuss their mutual problems. It is suggested that at a time when the flow of scientific knowledge is restricted for security reasons, many sections of engineering societies could profitably devote meetings to the methods and aims of engineering education so that, following its resurrection after the war, we may find it indeed a new and better agency for promoting the welfare of the profession and of mankind in general. Simultaneously, the educators should make use of the time available to consider the possibility of modifications in curricula which will more nearly approach the possibilities latent in a true engineering education, and should seek the assistance of practicing engineers who know their product—the engineering graduate.

British Thinking on Engineering Economy*

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This past winter I was looking through the current issues of the English publication, the *Journal of the Institution of Electrical Engineers,* to see what our British colleagues were thinking about during these war days. In Part 1 of the September, 1943 issue my attention was caught by a long article entitled "Engineering Economics" by Sir Frank Gill, K.C.M.G., O.B.E., Past-President I.E.E.; a paper which was read at a joint meeting of the Institution of Electrical Engineers with the Institution of Civil Engineers and the Institution of Mechanical Engineers in March 1943.

This paper is so full of interest to the teacher of engineering economy and the discussion so vigorous and voluminous that I decided to make a search through English engineering literature to see if this thinking on engineering economy is general.

Seemingly, the civil and electrical engineers are taking the lead in England in the field of engineering economy. At least, the mechanical and other engineering groups are not writing on engineering economy specifically, as are the civil and electrical engineers, although all the engineering branches are writing technical papers which involve economic aspects.

Although England has been at war for five years, her engineering profession has never lost the realization of their responsibility for England's position in the post war world. Their thinking and writing on engineering economy are considered as a definite part of their educational plans. It is significant that the articles, speeches, and actions discussed in this paper have been given at a time when England is fighting desperately for her existence.

The Report of the Council of the Institution of Civil Engineers for 1940–41 gives the following under the heading of "Post War National Development": "The committee has also given consideration to the need for fostering amongst engineers the study of the economics of engineering proposals, the organization and management of engineering works, and the relation of æsthetic consideration to engineering design and construction. . . . It was felt that the objects to be aimed at, namely (*a*) bringing to the notice of engineers during their education the principles underlying these subjects, and (*b*) establishing a center for research and study necessary to secure progress in these principles, could best be secured by setting up a course of study of lectures and other means at Cambridge University in conjunction with the Engineering School and under the control of the Professor of Engi-

*Presented at the 52nd Annual Meeting, S.P.E.E. (Engineering Economy), Cincinnati, June, 1944.

neering. On recommendation of the Committee, the Council have offered to the University of Cambridge to provide the necessary finance for this purpose for a period of five years."

Professor Charles Edward Inglis, O.B.E., M.A., L.L.D., P.R.S., President of the Institution of Civil Engineers, refers to this in his Presidential Address in November 1941: "Engineering is now shaping the destiny of civilization, it has vast potentialities for both good and evil and, side by side with his scientific training, a student should have his interest stimulated toward the humanitarian, the economic and even the ethical responsibilities of the profession that he is about to enter. To this aspect of engineering education the Council of the Institution is now giving serious consideration. They have voiced their hope that engineering education of the future will stress more fully the economic aspect of engineering undertakings, the general principles of management, the organization of works of construction, industrial psychology, and æsthetics in engineering design; and as tangible evidence of this educational ideal, the University of Cambridge has been given a subsidy to provide special teaching in these subjects."

The inaugural lecture of the series at the University of Cambridge arranged under this program was given by Sir Clement Hindley, K.C.I.E., Past-President of the Institution of Civil Engineers, on October 17, 1941, entitled "Engineering Economics, Organization and Æsthetics." He stresses that "modern developments, both in engineering practice itself and in the world at large, demand that an engineer must be not only a technician but also a man of business and a man of affairs."

The speech on "Engineering Economics" by Sir Frank Gill, given last year and mentioned at the start of this article, was the most informative, however. It and the discussion following seem to collect much of the pros and cons of present English thinking on engineering economy.

The essence of the paper is given in the summary: "The object of this paper is to try to give further impetus to the teaching of engineering economics in the universities and schools to every engineering student; to give to teachers in the schools some idea of what practising engineers mean by 'engineering economics'; to show the importance of the subject and how readily a knowledge of it can be taught; and to set out in an orderly manner one form in which estimates may be made and summaries presented for final judgment."

On reading this and other English references I find that their term "engineering economics" is synonymous with our term "engineering economy." Mr. Gill defines it here as "the wise handling of finance in engineering projects, relating to the question—Which of several alternative plans, schemes or designs, each technically sound for the same job, is it advantageous to select?"

Mr. Gill has been working for the adoption of courses in engineering economy by the English universities and engineering colleges for 27 years, starting during World War I. As a pioneer in this work, his thoughts have an added value because of his experience and long consideration of this subject. He suggests that the study of engineering economy should be divided into eleven sections: requirements; alternative designs; first costs; lives; residual values; interest; annual

charges; depreciation; estimates; interpretation and recommendations. Much of his paper is given to examples which illustrated these various divisions.

In teaching engineering economy, Mr. Gill believes that the student should understand the trusteeship in which the professional engineer finds himself by reason of his relationship to the finance of those who employ him; that he should realize the necessity for alternative plans and the use of cost comparisons before making a selection from among the alternatives; and that he should use the same methods to assist his judgment when considering taking a plant out of service while it is still capable of continuing to give service. The student should endeavor to find the method by which he can achieve his aims, by various technical means, in the manner most advantageous financially, and he should recognize the cases in which it is not economical to push the quest for technical efficiency to the last degree, because the cost of obtaining additional efficiency may become too burdensome.

The ten pages of discussion of Mr. Gill's speech sound much like some of the discussions in the Engineering Economy sessions of S.P.E.E. conferences. In general the discussors are much in favor of including engineering economy in engineering curricula, although there were some dissensions, notably one professor who suggests "that the student in his final year can master the elements of engineering economics in a quarter of an hour in a single lecture!" Many of the discussors stress that an engineer is only partially trained and is not equipped for his profession unless he has a good understanding of the principles of engineering economy and that he should study those principles while he is acquiring his basic technical knowledge. The difficulty, in England as here, is how courses in engineering economy can be introduced into a curriculum now crowded with technical courses. Several discussors, particularly the younger ones, felt that the present curricula were designed for the research and development engineer, and that it would be advantageous for the majority of engineering students if some of the highly technical and specialized courses were omitted or put in the graduate years and the student given a basic understanding of the principles of engineering economy and management.

Our British colleagues are thinking and planning about engineering economy. It will be worth our while to keep in touch with their progress.

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Discussion of S.P.E.E. Committee Report on Engineering Education After the War

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General Comment

This report constitutes a worthy successor to, and extension of, the 1940 Report on Aims and Scope and marks another milestone in the advancement of engineering education in the United States. It is not a document to be hastily read and laid aside but is rather something to be studied, pondered and restudied by each engineering educator, in the light of his local situation. The report may be accepted as a sort of constitution for engineering education, the by-laws to be added by the individual institution in accordance with its interpretations and its needs.

In commenting * on the 1940 Report the writer once expressed his feeling that in its attempt "to be all things to all men" many of the recommendations were inherently contradictory; that the plan then projected for engineering education was in more the wash drawing than the blueprint stage. While the 1944 Report is still highly idealistic, the writer is strongly and favorably impressed with the progress that has been made toward definiteness and practicality. He wishes especially to commend the introduction, the first paragraph of which sets forth in one broad stroke the function of the report. The fourth paragraph effectively summarizes the essential differences between war and peace-time educational objectives and methods (something which cannot be emphasized too strongly or too often) while the last paragraph of the introduction takes frank cognizance of the limitations to what this or any other report can expect to accomplish.

Although the long range aspects are not to be minimized in their ultimate importance, the fact remains that it is with Part II (Matters of Immediate Concern) that most of us will be grappling for the next few years. It is with some of these that this discussion is most concerned, not as items which the Committee overlooked (for the Committee seems to have accomplished a remarkably complete coverage) but rather to underscore certain items for added emphasis.

Impact of the War

In this war era the railroads of the country have performed, in the face of unnumerable handicaps, with an effectiveness never before approached—and aren't we hearing about it! Like the railroads engineering education has seemed to thrive on war-born difficulties; the engineering colleges have been able to provide training for many thousands of young men needed for

* Journal of Engineering Education, Volume XXXI, No. 4, December 1940, page 322.

key positions in industry and in the armed services, and aren't these young men delivering with history-making effectiveness! Why shouldn't we educators also be bursting our hat bands and throwing our arms out of joint as we see graduates of a few months literally toe-dancing under weights of responsibility which, in other times, men under forty (or over it) rarely got the chance to shoulder; loads which five years ago would have broken the back of a Jean Valjean.

The railroads haven't a thing on us. Of course we have done and are doing a marvelous job, the biggest and finest *emergency* job on record. Like the railroads, we are also doing the poorest job of recent times.

The analogy to the railroads is apt and real. At enormous cost, by overworking equipment and personnel and by the introduction of all manner of makeshifts, the railroads are rising to a war-time emergency to do what is an intolerably poor job on the basis of peace-time standards. Roadbeds undermined and unsafe from lack of maintenance; rolling stock bad and getting worse; wrecks plentiful and on the increase (only the biggest ones count as news now-a-days); reservations and priorities impossibly difficult; aisles filled; schedules uncertain; plumbing and air-conditioning often out of repair; dining car service . . . ; need we go on?

We too have a task of rehabilitation comparable to that of the railroads and, until these problems of the immediate future have been successfully negotiated, many of the forward-looking innovations discussed so ably in the first portion of the report will have to remain virtually untried and certainly unrealized.

But, specifically, wherein does the railroad analogy indict our present effectiveness and quality of output? According to war conditions and standards our youth, hastily trained (though relatively uneducated), are apparently doing what needs to be done and doing it better that the Axis is doing it; that much we can readily concede on the basis of the overall results secured, even though the point might be subject to argument on the basis of individual personal performance and relative resources.

A crude but rather graphic definition of an engineer once widely current was: "An engineer is one who can do at reasonable cost what almost any man could accomplish with unlimited resources at his disposal." On the basis of this definition (and after all it isn't a bad one) War doesn't use the engineering arts; it misuses them. It has to do many engineering things but always in an uneconomic (an un-engineering) way: wastefully, recklessly and always at terrific cost. The military method is to get there at any cost; intermediate failures are ignored or forgotten promptly; only the final result counts. In civil practice one Quebec or Tacoma Bridge, one St. Francis Dam is enough to outweigh and obscure dozens of successfully operating kindred structures. To train engineers for war performance is one thing; to educate for peace-time practice is quite another.

How We Got This Way

Under war conditions speed, emotionalism and expediency take dominance over quality, logic and principle. Whether it be in the realm of clothes, food or workmanship; of romance, prejudice or conduct; of honesty, fairness or public health, the war trend

is always downward toward the virile driving materialism and mediocrity of primitive man.

Education, as the very spearhead of civilization, is bound to be badly battered and blunted by the impacts of war. Speed, emotionalism and expediency have taken and are taking their toll not only of educational performance and substance but also of educational sensibilities and judgments. These too are deadened and blunted; just as so often happens, Nature seems to provide, along with her devastating devices, a counteracting opiate or sedative; an unwarranted but comforting sense of well-being and successful accomplishment. Few indeed are the engineering educators who have any full conception of the extent to which academic standards have been lowered in comparison with what, but a few years ago, were considered to be minimum requirements. The run-down condition of our academic roadbed and rolling stock has been due more to a general easing up or loosening of the scholastic fiber all along the line than to specific tangible items. Nevertheless, the cumulative effect of a number of fully warranted minor easements is itself appreciable even though, when viewed individually, most of them appear small and relatively insignificant. Among these are:

1. Liberalization of policies on substitutions for essential work.

2. An increasingly generous attitude toward awarding full term credit where men have been called early by the armed services or are needed in industry.

3. Easing up on the examining processes by shortening the period allotted to examinations or by waiving them altogether (which must be done anyway for the men who leave before the work of the term has been completed).

4. The continuous program has constituted a drain on staff and students alike contributing toward staleness and reduced interest and efficiency.

5. Teaching over-loads and increasing sizes of sections, sometimes from teacher shortages and sometimes to meet such specifications as those of even the otherwise far-sighted and ably administered Navy V-12 Program.

6. Much by way of teacher substitutions and makeshifts has been necessary in spreading and utilizing teaching personnel. Both youth and age have served as pinch hitters and there has been much shifting of teaching personnel between related (and not too related) fields. In such shifting about there is inevitably a loss in teaching effectiveness; sometimes not serious; at other times very, very serious.

7. Many schools have made some provision for service credit. Initially the intent, in most cases no doubt, was to limit such credit to elective and supporting subjects but there has been a pronounced tendency toward letting the specified periods of service apply as credit for any portion of the work.

8. Student interest and power to concentrate have been badly undermined by the uncertainties of the times and by the great amplification of the everpresent conflict between inclination and duty; between impulsive and considered action.

9. The physical training "hardening up" programs have sometimes been so strenuous and poorly scheduled as to interfere seriously with scholastic performance.

10. Faculty psychological factors in most cases probably far outweigh any of the foregoing. Anxiety to get the

student out into service or production; sympathy for the stirred up state of the student mind; realization that the teaching job may not have been too well done and a host of other extenuating aspects have created an unparalleled softness of professorial hearts which has at times been still further augmented and pyramided by tender gilt-edged administrative emotionalism (for the colleges do need students).

It should be kept in mind that very little that the colleges have done is subject to valid criticism any more than what the railroads have done—or industry. Just because such measures are necessary doesn't mean, however, that they are not debilitating; that they do not need correction just as rapidly as possible, once the emergency is past.

War Not Solely to Blame

The war is not solely to blame, however, for the present degradation of engineering standards and scholastic effectiveness. For several years prior to the war the quality of engineering instruction was being seriously undermined.

The writer doesn't pretend to know whether it is because of John Dewey or the so-called progressive education, or in spite of such, that the output of the high schools has been so progressively downward. Suffice it to say that the high school product has, for engineering purposes, been becoming steadily worse. The 1944 S.P.E.E. Report takes frank cognizance of this serious condition. On page 607 we find, "It has also become increasingly clear that secondary education needs to be strengthened, especially in mathematics and science, as a means of preparing for collegiate engineering education and means to this end must be sought vigorously." Again on page 608, "Evidence is appearing to support the belief previously held but based upon only partial proof that secondary school education unless specially planned is generally inadequate as preparation for collegiate engineering education. By means of the qualification tests of the Army and Navy college training programs students possessing high scholastic aptitude have been selected; yet poor preparation, especially in mathematics and science, has caused the failure of large numbers of the students of top ranking ability among high school graduates. The results of these tests are also indicating wide variation in the quality of secondary school preparation in various parts of the country." A bit farther along, "At the same time, evidence of the war training programs indicates plainly that the practice of indiscriminate admission of students wherever it obtains should be abandoned in favor of one of greater selectivity."

Another dangerously undermining pre-war trend which already had wrought considerable havoc with engineering standards of performance on some of the large campuses of the country was the dubious philosophy that basic technical work could be taught as effectively in sections of 25, 30 or 50 students as in sections of the 15 or 20 size. Even where the increased section sizes had not yet been forced into the college of engineering, the adverse effects were becoming more and more apparent as students entered upon their engineering sequences with ever poorer preparation in the mathematics and other basic sciences taken under loud-speaker auspices.

There is no reason to believe that this problem will not continue to be present as one of the serious threats to sound teaching. The fight for the educational dollar is bitter; the large-section philosophy has metallic outcroppings; some of the arguments carry a semblance of plausibility; a little plausibility weighs heavily on troy scales; the philosophy has administrative appeal; it will doubtless continue to have considerable administrative backing.

The railroad situation is, according to peace-time standards, very bad but it has not yet reached bottom; nor has our own educational situation reached the bottom of the decline; we're still headed downward but we've now reached the stage where, if the trend is ultimately to be reversed, the current situation must be recognized and correctly appraised; we can't continue to kid ourselves into the complacent fiction that a magnificent emergency performance has any workable place in a peace-time era. Brakes must be applied and critical problems just ahead must be faced thoughtfully and sympathetically.

The Ex-Service Man and Related Problems

The ex-service man problems were serious after the last war but because of the greatly increased numbers and the longer and more severe period of service, the difficulties previously encountered seem destined to be multiplied.

We must deal with the ex-service man considerately and liberally on the one hand but if the diploma or certificate of attendance is to be of value to him he must not be shortchanged on what he is held for and gets. It will be very difficult to be sympathetic without being sentimental; to be patiently helpful but firm in adherence to the degree of mastery demanded for minimum acceptable performance. In many cases the administrative angle will be a complicating one since, in a sense, each Veterans' Bureau student is a revenue producer for the institution; an asset not lightly to be eliminated just because of failure to meet prescribed academic standards of performance.

If we are to avoid an epoch of willy-nilly educational procedures during which a college diploma will have little meaning beyond indicating that the bearer was in the armed service and resided on a college campus at government expense for a period thereafter, it is up to us to give prompt serious study to some of the questions just in the offing and to evolve fair, well thought-through answers for them. To that end it will be well to scrutinize some of these probable questions while still sufficiently in the abstract to be viewed objectively.

As one case in point let us assume a substantial, mature man apparently with a good mind, serious intent and a purple heart but whose academic background is irregular. Perhaps he never finished high school but has since had considerable practical experience along engineering lines and has completed courses taken under the Armed Forces Institute. He wishes to secure a degree in engineering.

Here is a man who merits and should have every possible consideration. For such an obviously deserving case there is likely to be a predisposition to grant provisional credit liberally, which may amount to a serious disservice. Liberality in signing off elective or non-technical subjects may well be justified on the basis of ma-

turity and breadth of experience, but no amount of merit, maturity and experience will supply a workable substitute for algebra, calculus or any other middle-of-the-road technical requirement. Just a bit too much "benefit of the doubt" in such a case puts the man up against a difficult and discouraging situation even if, through the grace of God and a tender-hearted instructor, he secures a passing grade without having to back up and mop up, with consequent loss of time because of the false start. Moreover, if he does go ahead he is weakened in all the remaining courses of the sequence. In such cases laxity is not a kindness and generosity is not a teaching virtue.

It is clearly to the best interest of both the student and the institution that in every case containing elements of irregularity or doubt, prompt and definite advance validation be required for transfer of credit in any basic engineering subject. Better to probe thoroughly at the beginning than to attempt superficial treatment with hazard of technological lockjaw or gangrene. The painless dentist isn't always the best one.

Junior College and Liberal Arts Pre-Engineering Credits

During recent pre-war years the junior colleges have been coming more and more prominently into the field as a definite part of the public educational system. Over large areas of the country they are here and are evidently on the increase. Whether we approve or disapprove of the one- or two-year junior college as an intermediary between high school and the engineering college has little bearing on the subject. In those portions of the country where junior colleges are plentiful there is a rather wide range in the quality of the junior college output. Probably there is not a great deal that the engineering colleges can do toward controlling the type and quality of the junior college offerings but the work of the professional engineering college is bound to be affected adversely unless it takes unto itself certain protective measures as a safeguard against technical undermining.

The writer believes that both the 1940 S.P.E.E. Report on Aims and Scope and the 1944 Report on Post War Engineering Education have been remiss in their failure to take cognizance of the impact of the junior college movement on engineering education. Having virtually ignored the junior college but having gone positively on record in both reports for a basic four-year curriculum, the engineering college finds itself with a four-year allotment from which the junior college proposes to snip off the first two years. The more agressive of the junior colleges (and many of the smaller liberal arts colleges which, as regards engineering education, fall squarely in the junior college bracket) have been bending every effort to force the accrediting hour for hour, for freshman and sophomore work taken under junior college auspices.

Even without post-war complications the threat is too real to be ignored but certain aspects of the post-war education program make the matter so acute as to suggest a need for firm prompt action.

With large numbers of ex-service men interested in securing or resuming college work toward an engineering degree there will doubtless have to be a great deal of screening, readjusting and conditioning before many of these men are in shape for tackling the professional aspects of the work. The

liberal arts colleges, especially the small ones most of which have had very tough financial sledding in recent years, will undoubtedly have, and appropriately so, an important part in this program. They should be able to serve a valuable and useful function as classification and reconditioning centers. After one or two years, those qualified persons who want engineering would be passed along to the engineering colleges.

Unfortunately the G. I. Bill of Rights provides for not in excess of four years of subsidized education which, for those spending two years at a pre-conditioning college, leaves only two years available for the professional aspects of the college course. While two years of pre-conditioning would doubtless be highly desirable in many of the cases (and if the work is of proper quality and well given it should be objectionable in few, if any, of them), the fact remains that two years is not adequate for the professional aspects of the work. In the face of this dilemma the liberal arts colleges will want to do what the more ambitious of the junior colleges have been trying to do for years, namely, teach the calculus and some of the other beginning courses of the engineering sequences, including the first course or two in mechanics.

With only rare exceptions experience has shown that liberal arts, mathematics and mechanics make a very shaky foundation upon which to build the subsequent courses of the sequences. Provisional acceptance of junior college and liberal arts statics has, in the writer's experience, been so universally unsatisfactory that he has for a number of years accepted transfer statics only on the basis of validation examinations, which a few of the stronger applicants do negotiate successfully. If our engineering colleges are to be protected against pressure to accept on a transfer basis a lot of very weak foundation material, the S.P.E.E. (preferably with the sturdy backing of E.C.P.D.) needs to take a strong stand essentially as follows:

Not less than three years of any undergraduate engineering curriculum must be reserved for the professional sequences to be taken in residence under strictly engineering auspices. Work in the professional sequences taken under any other auspices is acceptable only on the basis of validation by examination.

Such a stand firmly taken would be of great assistance to many engineering colleges in their attempts to maintain standards in the face of a variety of undermining types of inroads. Always, and especially in the times just ahead, the door should be left wide open (via the validating examination) for the occasional strong student who can demonstrate a proficiency that warrants advancement regardless of whether such mastery was acquired under junior college or liberal arts auspices, from work taken with the Armed Forces Institute or some other form of extension or correspondence study, or by self study. Correspondence study has rarely proved satisfactory for basic courses; the student usually gains little beyond facility in the use of a handbook and plugging values into formulas of which he has little or no understanding. Even here, however, there will be occasional exceptions for which non-acceptance of credit would work an injustice. Thus while we need to do everything in our power to insure that the diplomas passed out to the ex-service men are up to the best of

civilian standards we must be equally insistent that no qualified man be held back because of pedagogical inflexibility or red tape.

Requiring the reservation of three years for the engineering sequence does not necessarily influence the length of the curriculum except for those who prefer to take two years or more under non-engineering auspices. By planning the freshman year properly some of the stronger of these other institutions should be able to give one year of readily accreditable work. If they insist upon attempting the second year they will be committed to a five-year plan *unless they can actually teach beginning engineering work that will survive validation.* If so, the more power to them.

The other two-year schools (virtually all of the junior and liberal arts colleges) will naturally "kick against the pricks," contending that they are being penalized. That matter is, however, scarcely our concern; it is our responsibility to dispense and safeguard engineering education. Let us assume that responsibility with something of the same positiveness and seriousness the medical profession displays with regard to safeguarding its educational standards.

Lengthened Curriculum

While, as pointed out in the preceding paragraph, the recommended stipulations do not necessarily influence the length of the curriculum, they should go far toward satisfying many of those who question the wisdom of the 1940 and 1944 commitments to the basic four-year curriculum. These measures should allay some of the impatience for a lengthened curriculum even though that question is one that will recur and on which the Committee recommendations may eventually experience a reversal. The 1940-length-of-curriculum commitment was made virtually by indirection.

In the opening paragraph of the 1940 report (Journal of Engineering Education, Volume XXX, No. 7, March 1940, page 555) it is pointed out that it was agitation for a lengthened curriculum which gave rise to the appointment of the committee and the ensuing study: "The appointment of this committee was authorized at a joint meeting of the council and institutional delegates held during the annual convention of June, 1939. The occasion for its appointment was the discussion, which had been active for some time, of the need of extending the period of undergraduate curricula to five or six years. There was active discussion also of the desirability of a preliminary period of study in schools of liberal arts before admission to the engineering school."

In the third paragraph the report states: "In directing its attention to the matter of the length of the curriculum, the committee has naturally and of necessity considered the broader aspects of engineering education which bear upon the specific problem and presents its report as one dealing in general with the aims and scope of engineering curricula."

Having thus introduced and summarily dismissed "length of curriculum," this report proceeds to deal at length with "the broader aspects of engineering education" until on page 565, as a result of these deliberations, the report concludes: "The present flexible arrangement of four-year undergraduate curricula followed by postgraduate work will better meet the needs served by engineering education

than will longer undergraduate curricula of uniformly prescribed duration."

With length of engineering curriculum so neatly disposed of "before the war," it becomes easy to carry on, in the more recent report on "Engineering Education After the War," by simply letting "sleeping dogs lie." Thus we find, in the 1944 report (Volume 34, No. 9, May 1944, page 592), that the four-year curriculum is accepted as more or less axiomatic: "For all the programs mentioned we believe that the first three years should conform, etc. . . . generally four academic years required for the award of the baccalaureate degree."

The treatment accorded to the length of curriculum issue is a bit reminiscent of the minister who after announcing his text departs therefrom and never returns, but the surrounding conditions are such as to have practically precluded a successful attempt at forthright handling of this inescapable aspect of curriculum building. In spite of the many proponents of a longer-than-four-year engineering curriculum, there is a baffling lack of agreement on how the extra time, once secured, should be utilized.

Breaking down the different schools of thought, we find:

(*a*) A limited school which maintains that the additional time is needed to offset the rapid advances which have, from the beginning, characterized the engineering sciences.

(*b*) A very large contingent which sees added breadth and culture as the engineer's great need. It sees in the engineer of today about what an Arab sees in a camel: an indispensable but uncouth, smelly and ill-dispositioned beast; a robot; a greasy, illiterate individual who sure can use a monkey wrench and a slide rule but who is naught but an embarrassment and a liability in polite society. This second contingent is a very optimistic one, each segment thereof having its particular formula for humanizing and civilizing the engineer. There are those, who, being ever (and perhaps a bit overly) conscious of the virtues of doctors and lawyers as exemplars of great culture, breadth, and civic righteousness, would solve all problems by simply casting the engineer in the doctor-lawyer type of mold, namely: require the liberal arts degree as prerequisite to the study of professional engineering.

(*c*) Others see the engineering student too crowded by a lack of time; they see him as a poor overworked grind; one whose curricular demands are so heavy and exacting as to deprive him of participation in campus affairs; no athletics, debating teams, glee clubs, dramatics or student politics; time for neither play nor thought. The projected cure for this situation is simply to spread the existing four-year program over a five-year period.

(*d*) Then there is the educationist group to whom the time is incidental; it contends that a little more maturity is the need; that two more years of high-school junior-college adolescence will carry the youngster safely past the age of educational puberty to the stage where he can begin to grow engineering whiskers and by commencement day can be wearing on his professional chin the goatee of culture, citizenship and competence.

(*e*) Paralleling the foregoing is the closed-shop philosophy based on the assumption that there are too many engineers and that an added educational requirement of one or two years would freeze out some of them (one related assumption being no doubt that those

frozen out would be the least promising, a questionable premise since there is little evidence of close correlation between ability and either economic means or persistence). For this group specific use of the extra time is not so important, four years of liberal arts having perhaps the greatest appeal since it constitutes the highest hurdle.

In the face of such diversity and conflict of reasons for a curriculum of greater length, the two S.P.E.E. committees seem to have been fully justified in going back to what they have termed "the broader aspects of engineering education," leaving the important item of the time to be allocated to the curriculum for consideration only after the curricular content had been definitely enough outlined to make a time estimate possible. Even now after the publication of these two forward looking reports, the programs are still in such broad outline form that any convincing commitment depends upon individual interpretations placed upon some rather idealistic generalizations. The conclusion of the 1940 Report and the implication of the 1944 Report that four years is adequate for the S.P.E.E. program cannot be accepted as a considered final judgment but simply as a matter of majority committee opinion qualified by several factors.

One point of view for which there is considerable justification is that by planning in terms of a four-year basic program, the strong students able to maintain the pace can do the job in the allotted four years while the others who need more time will automatically get it as they drop back and have to repeat some of the more difficult courses. While this is true its weakness lies in the fact that the curricular structure of a planned five years should differ materially from the chance arrangement brought about by emergency make-shifts. In fact, the planned five years would provide the pattern for the completion of which some of the slower students would doubtless need all or part of a sixth year.

As mentioned previously, these allusions to a four-year basic curriculum have overlooked or ignored the type of situation with which we are now confronted. They blandly assume that the stipulated four years will be taken at an accepted engineering school, having taken no cognizance of transfer problems with regard to credits earned elsewhere and otherwise.

Insistence upon the reservation of a three-year minimum allotment for the technical engineering sequences definitely means, as mentioned previously, a minimum of a five-year curriculum where the two-year junior college is an established fact or where students transfer after two years of liberal arts. It means a seven-year minimum when superimposed on a liberal arts degree and can at present mean a four-year minimum where the work is all done at a typical present day engineering college or when a college sees fit to accept hour for hour a single year of junior college or liberal arts work.

The two-year plus three-year sequence will tend to concentrate nontechnical subjects (those of the social-humanistic stem) into the first two years, producing the stratified arrangement rather than that of the integrated parallel stems but it is believed that the parallel-integrated-stem arrangement can be preserved if the first two years are planned with care as to specific content and nature of handling. This would require a close cooperative linkage between the junior college (or

liberal arts college) and the professional school; a desirable but rarely a fully attainable condition.

At this stage little definite planning can be done on any aspect of the social-humanistic stem, for at present every twig of that stem is still shaped like a question mark. Just what should the stem and its branches comprise? To what extent can the contents be integrated and woven into sequences without tending toward narrow semi-specialization along only one of several possible and desirable non-technical lines at the expense of the others? How realistically can one course be related to another and made to build upon its prerequisite in the sequence? Who should and can teach these courses at the level required; should the teaching be by non-engineers indoctrinated with the engineering point of view and sympathetic to the engineering students' state of mind or should the work be handled by engineers specially conditioned for teaching this important and difficult non-engineering work? Would engineering students give a respectful ear to an engineering graduate who had thus deserted his own field? Could the non-engineering teacher in this twilight zone maintain his prestige among his own professional fellows? Should the teachers be young men of enthusiasm or older men of experience? What is the academic future for those who would strive to qualify for work in this field? What can be done to insure the respectful acceptance of such teachers and their efforts by engineering students?

Activation of the social-humanistic stem presents a complicated many-pronged question mark. About all we know at present is that neither courses nor teachers exist for the program contemplated. The current experimentation on the evolution of a "Social Relations Program" at Carnegie Institute of Technology by Professor Cleeton under Dr. Doherty's stimulation and guidance should be followed by engineering educators with the utmost of hopeful, sympathetic interest.

Other Post-War Problems

In considering such major and immediate post-war problems as those just discussed we must not lose sight of others silhouetted against the educational horizon.

Many persons, including some engineering educators, after having observed the excellent results obtained from special high pressure training programs conducted under Army and Navy auspices or by industry have been more or less carried away by the thought that such programs can be translated bodily into professional engineering teaching with striking improvement in results secured or rate of progress achieved.

While each engineering educator should scan these new possibilities searchingly and with an open mind he must keep himself ever conscious of the points succinctly stated in paragraph 4 of the 1944 Report (page 589). There are fundamental differences between both the objectives sought and the methods that can be employed successfully in *training programs* and those appropriate to serious broad-gage *professional education.* Undoubtedly there will be much pressure from well intentioned enthusiasts as well as from groups with financial axes to grind for the greatly increased use of visual aids and other training devices. Some of these embellishments and some of the new techniques developed will have

a legitimate (but usually limited) contribution to make; a policy of receptive conservatism (a readiness to be shown) is suggested. In a previous paper (JOURNAL, S.P.E.E., Volume 33, No. 5, January 1943) the writer has discussed some of the aspects of this problem.

Just now the educational air is charged and surcharged with "Post War Plans." Just as the S.P.E.E. *Post War* Plan (as set forth in Part I of the Report) shows no visible ravages of the conflict but is really just a reiteration and extension of the *pre-war* 1940 Report on Aims and Scope, so are virtually all of these other "Post War Plans" simply reincarnations of the same old Pre-War Ideologies of sponsoring groups, dusted off for resale. " . . . and each one as before shall chase his favorite phantom." The war is terrible and very disturbing; it is too bad it had to upset the applecart but since it did, and since we do like apples, let's make the most of it.

There is no harm with post-war plans (if we don't take them so seriously as to let them interfere with what needs to be done) but some of these plans, especially if they happen to have aggressive administrative backing, may tangle with sound engineering pedagogy (as engineers visualize it). We must be on our guard alike against damaging undermining, and every other type of aggressive inroad or of ill-advised irresponsible pedagogical experimentation at our expense. Cases can conceivably arise in which concerted action by S.P.E.E. and E.C.P.D. accrediting agencies will be needed to safeguard soundness of method and quality of output.

Engineering education needs the guidance and the control of the engineering profession and its educators; it must resist the meddling tendencies of crusaders from without the profession, however well-intentioned their proffered offices may be.

SUMMARY

In our desire to meet our obligations and responsibilities to Society, the Profession and the Student, we will do well to recognize that for the most part we must operate from here on out. We may or may not be satisfied with the type of preparation provided by the high school, junior college, or Armed Forces Institute; our pre-natal influence is not such as to give us much control over the academic inheritance now coming our way. If the pre-professional college treatments are poor, we must tighten up on our inspection methods, accepting only those portions of the current offering which measure up to necessary beginning standards. Indiscriminate acceptance of transfer credit from any unproved source is a potent cause for scholastic grief. Fair, searching validation examinations need to come much more actively into the professional engineering college picture than heretofore, especially as a means of fair appraisal for the ex-service men who will be coming to us with infinite variety in the strength and type of their technical-sequence backgrounds. The function of the validation examination should not only be that of excluding or holding back the poorly qualified; it is just as legitimate and desirable that it be employed much more widely than heretofore to advance applicants as far along on the engineering sequences as demonstrated proficiency will permit them to go.

We must resist unwarranted or weakening interference from without

the profession and we must resist undermining in all its insidious forms including indiscriminate acceptance of transfer credit.

We must stipulate the minimum period to be allocated definitely to the engineering sequences, *to be handled under strictly engineering auspices* (except where by actual validation examinations justification for shortening the period can be established). Three years is the period recommended.

We must not, while noting the weaknesses in the preparatory schools from which we draw, be blind to our own sloppy, shaky standards; blind to the fact that we have made, in the name of the war emergency (and, generally speaking, with full justification), departures (always downward) from the dictates of good teaching and sound standards; that with us, as with the railroads, what is a marvelous wartime job is a low grade peace-time performance; that we, like the railroads, have an uphill program of rehabilitation confronting us.

We must recognize that the years just ahead teem with human and psychological problems to a far greater extent than in normal times; that to be considerate, patient and helpful is one very necessary thing but that expediency and sentimentality must not be permitted to obtrude themselves into the scholastic picture. Our debt to the service man must not be paid in devaluated educational currency.

Necrology

CHARLES FELTON SCOTT

In the passing of Charles Felton Scott the engineering profession has lost a leader, the Society for the Promotion of Engineering Education has lost an elder statesman, and The Ohio State University an honored alumnus and loyal son.

Dr. Scott's father—William Henry Scott, a former President of the University—gave his son, as he gave many generations of students, a fine appreciation of the classical values of education savored by the war appreciation of the human touch in life's affairs. Young Scott's higher education started at Ohio University, in Athens. Coming to Ohio State he was graduated in 1885 with the degree Bachelor of Arts. Characteristically, however, he must have assumed that this was merely the threshold of his education for we next find him pursuing graduate work for one-and-a-half years at Johns Hopkins, at the same time teaching in a technical school of the Baltimore and Ohio Railroad.

In testimony of his attainments in scholarship, through the years he continued to receive honorary degrees from leading institutions; among these were, Brooklyn Polytechnic Institute, The Ohio State University, University of Pittsburgh, Rose Polytechnic Institute, Stevens Institute of Technology, the degrees conferred being doctorates in engineering and in science, and finally the degree of Doctor of Laws.

In 1888 the new science of electrical engineering took him to the Westinghouse Company where he entered the testing department. Nine years later he became chief electrician and in 1904 he was made the Company's consultant. During his career at Westinghouse he had an opportunity to combine his attributes of keen analysis and flair for invention. Among the accomplishments standing to his credit is pioneering in high voltage power transmission. These early stages in the electrical industry blazed the way for our modern high voltage power transmission lines which make possible the present status of the harnessing of water power as at the great dams in the west, and the utilization of economic centers for the location of modern steam-electric generating stations in the east. From much of his personal work came the advances in induction motors and transformers. The "Scott" or "T" transformer connection is one of the fundamental devices due to his genius in electrical matters. Under his guidance, investigations were made on the corona loss of high voltage lines. Another field of the early knowledge to which he made valuable contribution, is in inductive interference. To other than specialists, many of the statements which could be made respecting this man's contributions may be at best barely intelligible; we have, however, the confirming evidence of the tributes of the leaders in his profession.

Long a member of the American Institute of Electrical Engineers, he became its President in 1902 and throughout his membership served on many of its committees. Again delighting to honor this great scientist and technician, the American Institute of Electrical Engineers bestowed upon him the Edison Medal, one of the World's highest prizes in applied science. Membership in the Society of Sigma Xi, Phi Beta Kappa and the honorary engineering Tau Beta Pi, bore evidence of time devoted to the science-social side of his work.

The facts just related might indicate accomplishments enough—heaped up and running over—for one life time. To stop here, however, would be to say nothing about the broad humanitarian side of Charles Felton Scott. His interest in youth is attested by his going to Yale in 1911 as professor of electrical engineering in which work he continued until 1933 when he became emeritus. Through these years his association was closest with the Society for the Promotion of Engineering Education of which he was President in 1921–1923. In 1930 he received from the Society the Lamme Medal which is an award "to be given yearly to a chosen technical teacher for accomplishment in technical teaching or actual advancement of the art of technical training." Working indefatigably through the Society and its various connections, such as the Engineers' Council for Professional Development (of which he was one time chairman), as President of the National Council of State Boards of Engineering Examiners, Dr. Scott labored in season and out of season for the inculcation of engineering ethics and professional awareness on the part of the young men graduating from our technical schools. One of the strongest impressions retained of Dr. Scott is that of his untiring zeal toward the end that the young engineer be made socially conscious of his responsibility in our complicated society. The broadening of the social horizons of the professional man engrossed his thoughts until his last days.

Charles Scott reached these outstanding heights of scientific attainment without losing his warm-hearted human touch and with an abiding kindliness of spirit.

C. E. MacQuigg.

EDWARD FRANKLIN BERRY

The news of the death of Edward Franklin Berry, Professor of Civil Engineering at Syracuse University, on August 28, 1944, came as a shock to his many friends. His untimely passing will be greatly regretted by his many friends, colleagues, and acquaintances. He was born October 1, 1889, in Frederickton, New Brunswick, Canada, and was graduated from the University of New Brunswick in 1913. After serving at Lehigh University and the Texas Company, he was called in 1920 to Syracuse University as Assistant Professor of Civil Engineering and was appointed in 1939 to the position he held at his death. He was one of the organizers and the first chairman of the Upper New York Section of the S.P.E.E. He was also a member of A.S.C.E., Sigma Xi, Phi Kappa Phi, Theta Tau and Tau Beta Pi as well as several civic and fraternal organizations.

New Members

ALLEN, ALEXANDER J., Westinghouse Graduate Professor of Engineering, University of Pittsburgh, Pittsburgh, Pa. F. L. Bishop, Nell McKenry.

BEHRENT, LEWIS F., Assistant Examiner, Engineering Unit, U. S. Civil Service Com., Washington, D. C. P. A. Willis, E. J. Stocking.

BLAKE, ROLAND P., Senior Safety Engineer, Div. Labor Standards, U. S. Dept. Labor, Washington, D. C. H. T. Heald, F. L. Bishop.

CRAGLSKE, NORMAN H., Assistant Professor of Chemical Engineering, Washington University, St. Louis, Mo. T. R. Ball, A. S. Langsdorf.

COOLIDGE, WARREN A., Professor of Civil Engineering, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

CROSLAND, DOROTHY M., Librarian, Georgia School of Technology, Atlanta, Ga. R. S. Sweigert, D. P. Savant.

DUNKIN, WILLIAM V., Professor of Mechanical Engineering, Georgia School of Technology, Atlanta, Ga. Re-admission.

FADUM, RALPH E., Assistant Professor of Soil Mechanics, Purdue University, Lafayette, Ind. K. B. Woods, R. B. Wiley.

FOCKE, HELEN M., Supervising Librarian, Case School of Applied Science, Cleveland, Ohio. R. R. Slaymaker, K. O. Thompson.

GLENN, WM. DAVID, Associate Professor of Civil Engineering, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

JACKSON, NORMAN E., Instructor in Civil Engineering, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

JACOBS, SIDNEY N., President, Electronic Radio-Television Inst. Inc., 2055 Harney St., Omaha, Nebr. Geo. Risk, J. B. Hershman.

KATZ, DONALD L., Professor of Chemical Engineering, University of Michigan. Ann Arbor, Mich. G. G. Brown, A. H. White.

LAVALLE, PETER F., Engr. Examiner, Engineering Unit, U. S. Civil Service Com., Washington, D. C. P. A. Willis, E. J. Stocking.

LUNDBERG, GUSTAVE H., Instructor in Mathematics, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

MALBY, HOWARD S., Special Courses Instructor, Douglas Aircraft Co., 2910 Arline Ave., Artesia, Calif. F. A. Dow, C. T. Reid.

MALLORY, WALTER F., Professor of Mechanical Engineering, University of Colorado, Boulder, Colo. Re-admission.

MARCOUX, HELIODORE A., Assistant Professor of Mechanical Engineering, Georgia School of Technology, Atlanta, Ga. R. L. Sweigert, R. S. King.

MCCORMICK-GOODHART, LEANDER H., Instructor, Henry Ford Trade School, Grosse Pointe 30, Mich. H. E. Keeler, F. L. Schwartz.

MCDONALD, RAYMOND N., Assistant Professor of Mechanical Engineering, Vanderbilt University, Nashville, Tenn. J. E. Boynton, F. J. Lewis.

MCILVAIN, JOHN M., Administrative Supervisor, Research and Development Dept., Atlantic Refining Co., 3144 Passyunk Ave., Philadelphia, Pa. F. L. Bishop, Nell McKenry.

PETERSON, FRANK T., Mechanical Engineer, Technical Employment, Naval Ordnance Lab., Navy Yard, Washington, D. C. W. J. Seeley, R. D. Bennett.

PRICE, M. LAWRENCE, Assistant Professor of Machine Design, Worcester Polytechnic Institute, Worcester, Mass. Re-admission.

ROOK, CHARLES W., Assistant Professor of Electrical Engineering, University of North Dakota, Grand Forks, N. D. A. M. Cooley, Arthur Kath.

RUSSELL, DORIS A., Instructor in English, Northeastern University, Boston, Mass. W. C. White, H. W. Melvin.

SCHUMANN, FRED, Associate Professor of Electrical Engineering, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

STEIN, I. MELVILLE, Vice President and Director of Research, Leeds and Northrup Co., Philadelphia, Pa. Chas. F. Scott, F. J. Chesterman.

TILLER, FRANK M., Assistant Professor of Chemical Engineering, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

VAN VALKENBURG, MAC E., Staff Member, Radiation Lab., Massachusetts Institute of Technology, Cambridge, Mass. L. D. Harris, A. L. Taylor.

WEEDEN, CLARENCE R., Instructor in Mechanical Engineering, Georgia School of Technology, Atlanta, Ga. R. S. King, R. L. Sweigert.

WHITSITT, WILLIAM G., Assistant Professor of Electrical Engineering, Vanderbilt University, Nashville, Tenn. F. J. Lewis, S. R. Schealer.

Items of Interest

William L. Everitt of Washington has been elected President of The Institute of Radio Engineers for the coming year. Dr. Everitt, who is Chief of the Operational Research Branch, Office of the Chief Signal Officer of the United States Army, succeeds Professor Hubert M. Turner of the Department of Electrical Engineering at Yale University, New Haven.

At the 1944 Annual Meeting of the Engineers' Council for Professional Development, which was held in the Engineering Societies Building, New York, N. Y., on October 20 and 21, E. S. Lee, engineer of The General Engineering Laboratory, General Electric Company, Schenectady, N. Y., was reelected chairman and James W. Parker, president, general manager, and director, The Detroit Edison Company, Detroit, Mich., was relected vice-chairman. R. L. Sackett, assistant to the Secretary, A.S.M.E., New York, and George T. Seabury, secretary A.S.C.E., were elected secretary and assistant secretary, respectively.

For chairman of E.C.P.D. committees the following elections were announced: Committee on Student Selection and Guidance, A. R. Cullimore, president, Newark College of Engineering; Committee on Engineering Schools, D. B. Prentice, president, Rose Polytechnic Institute; Committee on Professional Training, C. A. Pohl, consulting engineer, New York; Committee on Professional Recognition, N. W. Dougherty, dean of engineering, University of Tennessee.

ERRATA:

Agricultural Engineering in November ENGINEERING EDUCATION:

Line 15, paragraph 2, page 229 should read,
"over a half billion of dollars."

Sections, Branches, and Divisions

Three sessions of the **Aeronautical Engineering Committee** were held, and all were well attended by representatives of colleges, universities, and the aircraft industries. The full participation of representatives of all branches of the industry indicated their desire to cooperate with educational institutions in an effort to improve the products of the teachers.

The first session convened at 2 p.m. on June 22, with H. W. Barlow, of The A. & M. College of Texas, presiding and with H. W. Stillwell, of the University of Kansas, as secretary. The following papers were presented:

"Training of College Women in Engineering," F. K. Teichmann, Guggenheim School of Aeronautics, New York University.

Discussion by Warren Bruner, Curtiss Wright Corporation and others.

"Postwar Plans for Cooperation between Engineering Schools and the Aircraft Industry," A. S. Levens, The University of California.

"The Use of Wind Tunnels in Undergraduate Instruction and Research," W. C. Nelson, Iowa State College.

"The Use of Industrial Materials in Aeronautical Engineering Courses," M. J. Thompson, The University of Texas.

"The Scope and Aims of Aero-Medical Courses and Their Relation to Aeronautical Engineering," F. R. Steggerda and M. K. Fahnestock, The University of Illinois.

"Aeronautics Options in Civil Engineering," Alfred S. Niles, Guggenheim Aeronautics Laboratory, Stanford University.

The second session convened at 7 p.m. on June 22. H. W. Barlow, of The A. & M. College of Texas, presided, and W. C. Nelson, of Iowa State College, was secretary. The meeting was concerned with the preliminary report of the S.P.E.E. Aeronautical Engineering Sub Committee on Curriculum.

Detailed comment was obtained from both the college and industrial representatives indicating a general agreement on the scope of the curriculum recommended by the Sub Committee. The number of technical and non-technical electives apparently give the course of study enough flexibility to adapt itself to the various demands.

A strong plea was made for cooperative courses wherever possible involving part time work in the aircraft industry. It was pointed out that this could be accomplished even when the school is at a great distance from industry if the work period at the plant is long enough to compensate. It was also felt that the field of technical electives should not become too narrow inasmuch as a high degree of specialization is best accomplished at the aircraft plant itself.

Professor Bruhn, of Purdue University, did not feel that the proposed curriculum was at all adequate for the aircraft engine field and suggested that it be completely modified to meet that objective.

Following this general discussion of the curriculum a conference was held with Dr. Prentice concerning aeronautical relations with E.C.P.D. Dr. Prentice reviewed the history of E.C.P.D. and its representation. After this the following motions were unanimously carried:

(1) that the Aeronautical Engineering Committee of S.P.E.E. recommend to E.C.P.D. a list of personnel qualified in the field of aeronautical engineering to assist in the inspection for accrediting of aeronautical engineering curricula.

(2) that E.C.P.D. be petitioned by the Aeronautical Engineering Committee of S.P.E.E. to add an additional organization to its council representing aeronautical engineering.

The final report of the Sub Committee is being prepared and will be published in the Journal of Engineering Education.

Approximately 35 were in attendance.

The third session convened at 2 p.m. on June 24, with M. J. Thompson, of the University of Texas, presiding, and L. Z. Seltzer, of Virginia Polytechnic Institute, as secretary. There were approximately 30 persons in attendance. No copies of the papers were available.

A paper entitled "Subject Matter for Fluid Mechanics for Undergraduate Students in Aeronautical Engineering" was presented by Arnold M. Kuethe, of the University of Michigan. A discussion followed the presentation.

A second paper was presented by R. W. Logan, of Braniff Airways, Inc. The subject was "Air Transportation Studies as a Branch of Aeronautical Engineering." The paper was followed by a general discussion.

Dean H. W. Barlow, of The A. & M. College of Texas, quoted some correspondence from American Export Airlines, Inc., outlining the subject matter that this organization would like to see included in an Air Transportation curriculum. After the discussion Dean Barlow suggested that a joint committee, composed of members from the colleges, airlines, technical institutes, manufacturers and the Air Transport Association, be set up to discuss an Air Transportation curriculum. The motion was seconded and carried. Interest in this subject was indicated by a large majority of the colleges present.

The **Co-operative Engineering Education Division** met in Cincinnati, June 22, 1944, with Chairman F. G. Seulberger, Northwestern, in the chair.

E. T. Howson, Railroad Age, explained the joint industry-university hookup, and then introduced H. J. Hoglund of the Chicago, Burlington and Quincy Railroad Company, who presented a paper on "Adaptation of the Co-operative Method to the Railroads." Mr. Hoglund explained that the railroads are now very much interested in the co-operative plan for training engineers for the systems.

G. W. Burns, Cincinnati, explained the early experience at Cincinnati with student contracts and suggested that none be used in the railroad co-operative plan. H. C. Messinger, Cincinnati, suggested that the students be called "student engineers" rather than "apprentices" to avoid trouble with union limitations in the co-operative plan. R. W. Renn, Cincinnati, commented that the Baltimore and Ohio Railroad now has one engineering girl co-operative student. J. E. McDaniel,

Georgia Tech, O. W. Eshbach, Northwestern, and C. J. Freund, Detroit, commented on the tie-up of railroads and industry.

Mr. Howson explained that sons of Railroad-Labor-Union men are now in the plan and the unions are sympathetic. He also explained that the railroads are now very much interested in the co-operative plan, especially in the Freight Claim, Yard Master, Train Master and Division Superintendent Departments.

Lemuel Adams of the Oxweld Service Company, Chicago, suggested that the civil-engineering co-operative training plan be expanded to include a full and definite program, the same as planned for mechanical-engineering and electrical-engineering students, instead of just noting that they will be rodmen, instrumentmen, and spend some time in track and bridge work. Mr. Hoglund agreed and will include the heavy work in the early part of the course.

W. B. Irwin of the Great Northern Railroad of St. Paul told about the system of student officers in use in their line. His company has not as yet used co-operative students but these student officers were employed as rodmen, chainmen, instrumentmen, and inspectors in the engineering department, and they were also working on mechanical jobs in the train master's department and for the superintendent of the motive power department. He was anticipating no trouble in starting the co-operative plan because the student officers had made such a fine record.

C. J. Freund, chairman of the Committee on Investigation of Basic Ideals of the Co-operative Method, reported on the reasons for having a charter. Copies of his report are to be mailed to the colleges for comment. When comments are received, the whole report is to be revamped and a second draft is to be submitted to the whole group. Dean Freund's committee is to continue for the next year. President Raymond Walters commended Dean Freund's report for its comprehensive range and its clearness of statement.

C. W. Park, University of Cincinnati, was unanimously elected chairman for 1944–1945.

G. T. ADDISON,
Secretary

The **University of Detroit Branch** started the year's activities in September with the following Faculty members holding office:

T. C. Hanson, *President,*
J. J. Uicker, *Vice-President,*
G. H. Tweney, *Secretary.*

Elections have just been held for the year, 1945, and at the first meeting in January, the following will assume officers' duties:

L. R. Blakeslee, *President,*
G. H. Tweney, *Vice-President,*
R. R. Johnson, *Secretary.*

Enrollment in the College of Engineering is down considerably over previous years, with a total enrollment of 261 students. To augment this however, 26 courses are being taught under E.S.M.W.T. auspices, with a total enrollment of slightly over 600 students. Faculty members not engaged in this extra-curricular teaching, are doing governmental and commercial research work; planning changes and improvements in their various department facilities and curricula, etc.

The only faculty change for t[illegible] year is the addition of Donald C. Hunt to the staff of the Department of Aeronautical Engineering. Mr. Hunt come[illegible]

from the Aircraft Development Section of the General Motors Corporation, and replaces Philip G. Blenkush, now an Ensign in the United States Navy.

In memory of Professor B. N. "Dad" Blakeslee, deceased Director of the Department of Architectural Engineering, a memorial fund is being set up. The first accomplishment of this fund has been the planting of two very large Norway Blue Spruce trees on both sides of the main entrance to the Engineering Building. These are suitably identified by a bronze plaque on the exterior of the building.

GEORGE H. TWENEY,
Secretary.

The Fall 1944 Meeting of the **Middle-Atlantic Section** was held on Saturday, Dec. 2, 1944 at the McGraw-Hill Building in New York City. The McGraw-Hill Book Co. and the McGraw-Hill Publishing Co. were hosts of the Section. The total attendance at the meeting was 410 of whom 51 were women. The luncheon, afternoon session and dinner were held at the Hotel Astor.

The business meeting of the session was called to order by Chairman Billings at 10:15 a.m. Mr. James H. McGraw, President of the McGraw-Hill Publishing Co., welcomed the membership in a brief address. The minutes of the May 1944 meeting were approved. The treasurer reported a balance on hand as of Dec. 2, 1944, of $73.44. The nominating committee under the chairmanship of Moreland King placed in nomination the following candidates for officers for the year 1945:

Chairman, C. D. Fawcett, University of Pennsylvania,
Vice Chairman, J. C. Elgin, Princeton University,
Sec.-Treas., F. D. Carvin, Newark College of Engineering.

There being no further nominations, the secretary was instructed to cast a ballot for the above candidates. Prof. E. B. Smith of the College of the City of New York moved that the officers of the section be authorized to represent the section on the National Nominating Committee of the S.P.E.E. The motion was seconded by President Rogers and passed.

The address of the morning was delivered by Harry S. Rogers, President of the S.P.E.E. and President of the Polytechnic Institute of Brooklyn. His paper was on the subject of "The Technical Institute and Post War Engineering Education." The morning session adjourned at 11:10 a.m. The next hour was spent in an inspection of the McGraw-Hill Building. A collection of old books was on display and the binding, mailing and shipping departments were open for inspection.

Luncheon was served at 12:30 p.m. at the Hotel Astor. The afternoon session was called to order at 2:00 p.m. by Chairman Billings who introduced Colonel Willard Chevalier, publisher of "Business Week." The afternoon session was a Panel Discussion of the topic "Tomorrow's Educational Needs of Business and Industry." Colonel Chevalier was the Panel Chairman and the panel program was as follows:

For Civil Engineering—Waldo Bowman, Editor of *Engineering News-Record,* and a discussion by Prof. J. K. Finch of Columbia University.

For Mechanical Engineering—Philip W. Swain, Editor of *Power*, and a discussion by Dean K. H. Condit of Princeton University.

For Industrial Engineering—L. C. Morrow, Editor of *Factory Management and Maintenance* with a discussion by Prof. David Porter of New York University.

For Chemical Engineering—Sidney D. Kirkpatrick, Editor of *Chemical and Metallurgical Engineering* with a discussion by Dean Albert B. Newman of City College of New York.

For Electrical Engineering—S. B. Williams, Editor of *Electrical World* with a discussion by Dean N. S. Hibshman of Pratt Institute.

The afternoon session closed at 5:00 p.m. and we spent a pleasant social hour until dinner at 6:00 p.m. After dinner, the section was entertained by an illustrated lecture on "Flight to Everywhere" by the noted War Correspondent Ivan Dmitri. His lecture was illustrated by pictures in colors taken in the Arctic, in the jungle and in the desert.

The program for the Ladies consisted of a tour of Radio City, luncheon at the Town Hall Club, and a talk by Rosemary Taylor, author of "Chicken Every Sunday," a tour of the Museum of Modern Art, bridge at the Town Hall Club and the evening dinner program with the men at the Hotel Astor.

A vote of thanks was extended to the McGraw-Hill Book Co. and the McGraw-Hill Publishing Co. for their excellent hospitality. The session adjourned at 8:45 p.m.

FRANK D. CARVIN,
Secretary.

The Fall Meeting of the **New England Section** was held at Harvard University, Cambridge, Massachusetts, on Saturday, **October 7, 1944. The total registration was 301 members and guests.**

Registration was held from 8:30 a.m. throughout the day.

The following conferences were held from 10 a.m. to 12:15 p.m.:

A. Chemical Engineering—attendance 12.

Chairman: Professor M. E. Othmer, Tufts College.

10.00 Subject: "Problems of a Chemical Engineer in Labor Relations."

Speaker: Mr. Thomas J. Oliver, Lever Brothers Co.

11.00 Subject: "Experimental Training in Labor Relations."

Speaker: Professor W. G. Whitman, M. I. T.

B. Civil Engineering—attendance 39.

Chairman: Professor E. A. Gramstorff, Northeastern University.

10.00 Subject: "Suggested Improvements of the Post-war Undergraduate Civil Engineering Curriculum."

Speakers: Mr. O. S. Bray, Engineer, Jackson and Moreland; Colonel Louis E. Moore, Consulting Engineer; Professor J. B. Wilbur, M. I. T.; Professor Albert Haertlein, Harvard University.

11.00 Discussion of Previous Talk

C. Drawing—attendance 23.

Chairman: Professor Eliot F. Tozz, Northeastern University.

10.00 Subject: "Drawings for Patterns, Forgings and Castings."

Speaker: Mr. Herbert C. Lan, Mason-Neilan Regulator Co.

Subject: "Modern Methods of Teaching Descriptive Geometry."

Speaker: Professor John T. Ro, M. I. T.

Subject: "War-time Standardi

tion for Specialized Precision Manufacture."

Speaker: Mr. J. T. Perrin, Standards Engineer, Pratt and Whitney Aircraft Corp., E. Hartford, Conn.

Subject: "Report of Activities of the National Division of Drawing."

Speaker: Professor Walter E. Farnham, Tufts College.

Subject: "A Discussion of the Present and Future of Pictorial Drawing."

Business Meeting.

D. Electrical Engineering—attendance 54.

Chairman: Professor A. H. Howell, Tufts College.

Theme: "Trends in Electrical Engineering Curricula."

10.00 Subject: "Adjustments Indicated by the Hammond Report."

Speaker: Dean W. C. White, Northeastern University.

11.00 Subject: "Electronic Applications—A New Curriculum in Electrical Engineering."

Speaker: Professor T. S. Gray, M. I. T.

E. Engineering School Libraries—attendance 12.

Chairman: Miss Myra White, Northeastern University.

10.00–12.00 Round Table Discussions: What the Engineering School Librarian should know about new trends in Engineering.

Report of the Cincinnati Meeting.

Discussion of plans for a symposium on technical libraries.

F. English—attendance 27.

Chairman: Dean H. W. Melvin, Northeastern University.

10.00 Subject: "Improving the Basic Reading Skills of College Freshmen." (Illustrated remedial reading films will be shown through the courtesy of Harvard University Film Service.)

Speaker: Professor W. F. Dearborn, Harvard University.

10.30 Subject: "Techniques of Remedial Reading on the College Level."

Speaker: Dean D. D. Durrell, Boston University.

11.00 Discussion of preceding talks led by Professor H. R. Bartlett, M. I. T., and Prof. R. G. Webster, University of New Hampshire.

G. Mathematics—attendance 21.

Chairman: Prof. James A. Bullard, University of Vermont.

10.00 Subject: "What Have We Learned from Teaching the Army and Navy Programs?"

Speaker: Professor B. H. Brown, Dartmouth College.

11.00 Subject: "A Non-electrical Account of Communications Engineering."

Speaker: Professor Norbert Wiener, M. I. T.

H. Mechanical Engineering—attendance 28.

Chairman: Professor F. W. Keator, Yale University.

10.00 Subject: "Course in Safety vs. 'Safety' in Courses."

Speaker: Professor E. O. Waters, Yale University.

11.00 Subject: "Humanistic and Social Science Subjects in the Mechanical Engineering Curriculum."

Speaker: Dean F. W. Roys, W. P. I.

I. Physics—attendance 25.

Chairman: Professor C. E. Bennett, University of Maine.

10.00 Subject: "The Physics Curriculum at M. I. T."
Speaker: Professor F. W. Sears, M. I. T.

11.00 Subject: "Comments on the Engineering Physics Curriculum."
Speaker: Professor A. O. Williams, Jr., Brown University.

From 12.30 to 1.30 a buffet luncheon for the men was held at the Harvard Faculty Club with an attendance of 198. Following the luncheon, from 1.30 to 3 p.m., an inspection was made of laboratories of the Engineering School and points of interest of the University.

At 3 p.m. a brief business meeting was held in Room 110, Pierce Hall. Professor Dawes called the meeting to order and introduced Professor Albert Haertlein of the Harvard Engineering School who extended a cordial welcome to those present on behalf of Dean Westergaard of Harvard University. The minutes of the 1943 meeting, as read by the Secretary, were accepted. The Chairman next introduced Past Presidents C. Frank Allen and C. F. Scott who made brief remarks.

The Chairman directed attention to the appointment of Nominating and Resolutions Committees. He also stated that the Section would be glad to receive invitations from any of the member Institutions to meet with them for the 1945 convention.

The afternoon meeting was held in Room 110, Pierce Hall from 3.30 to 5.30 p.m., with an attendance of 143 and the following program:

Subject: "The Accrediting of A.S. T.P., E.S.M.W.T., V–12, and Army Institute Credits."
Speaker: Mr. D. T. Shank of the American Council on Education.
Subject: "Post-war Curriculum Planning."
Speaker: President H. S. Rogers of Brooklyn Polytechnic Institute, President of S.P.E.E.

The annual dinner was held at 6.0 p.m. at the Hotel Continental, Cambridge. The attendance was 16 Following the dinner, Professor Dawe called on the Secretary who read th constitution of the Section and al gave a few statistics.

Professor C. A. Brautlecht pr sented a report for the Nominati Committee in which Professor C. Dawes was nominated for Chairma Professor C. E. Tucker for Secreta and Dean Frank W. Garran for Se tional Representative on the Natio Nominating Committee for the ens ing year. The nominees were du elected.

Professor R. H. Frazier, Chairma of the Resolutions Committee was th called upon and presented the follo ing resolutions which were una mously accepted by the Section:

"Your Resolutions Committee wish to express on behalf of the members the New England Section a sincere a preciation of the efforts of all who co tributed to the success of this Fa Meeting, either by facilitating the a rangements or by participating in t program, many with some perso sacrifice owing to pressure of w work.

"In particular, your committee wish to express appreciation of the hos tality of Harvard University, and e pecially to thank Mr. C. J. Walsh, M

A. E. Haertlein and other members of local committees that arranged for the efficient and pleasant functioning of the activities of the day; to thank Chairman C. L. Dawes, and Secretary C. E. Tucker for initiating and guiding the planning of the meeting; and to thank Professor L. F. Cleveland and his committee for producing the interesting News Bulletin."

Signed: Resolutions Committee:
K. P. Hanson,
F. O. Rose,
R. H. Frazier, Chairman.

Professor Dawes then introduced President H. S. Rogers of Brooklyn Polytechnic Institute who, as President of S.P.E.E. gave greetings to the Section.

After President Rogers' address, the Chairman introduced Mr. H. M. Kingsbury of Hanover, New Hampshire, who gave a talk illustrated with motion pictures on the subject "The Land that Time Forgot." The pictures were taken by Mr. Kingsbury while exploring in New Guinea as a mining engineer, and showed the vast interior of this island, hitherto totally unknown. The pictures were taken just prior to the recent Japanese invasion. The meeting adjourned at 9.30 p.m.

The visiting ladies who totaled 75, were entertained by a committee under the chairmanship of Mrs. A. E. Haertlein. During the morning the ladies enjoyed a guided tour of Harvard Yard, Memorial Church, Widener Library and the Ware Collection of Glass Flowers. At 1.30 p.m. they attended a complimentary luncheon at the Harvard Faculty Club. This was followed by a Musicale and Tea also held in the Club, with Mrs. Helen C. Bedford as Harpist. They joined the men for dinner at 6.00 p.m.

The financial report through October 24 is appended.

FINANCIAL REPORT

October 24, 1944

Receipts:	
Cash in bank, November 24, 1943	$18.90
Interest	.13
Receipts from Harvard meeting	50.88
	$69.91
Expenditures:	
Printing	$39.40
Postage	15.11
Telephone	.60
Mimeograph	1.44
Cash in bank, October 24, 1944	13.36
	$69.91

CARLTON E. TUCKER,
Secretary.

On November 14, 1944, following a group dinner, the **Northeastern University Branch** of S.P.E.E. met in the Student Union of Richards Hall to discuss the humanistic-social stem of post-war curricula in the College of Engineering. Twenty members were present. Following the reading and approval of the minutes of the previous meeting, Chairman L. F. Cleveland appointed a nominating committee to report at the next regular meeting of the branch in the spring of 1945.

Prof. Cleveland began the discussion by presenting a brief outline of the "Hammond Report" and indicated that the general trend of all engineering training during the war has been to eliminate much of the social elements in the curriculum, with the result that students now graduating tend

towards being Technicians rather than Engineers.

Copies of the digest of the Hammond Committee Report and an outline of the principal issues relative to humanistic-social content were distributed to members of the group as a basis for detailed discussion. Objectives of the humanistic-social stem were considered first. There was unanimity of opinion as to the excellence of the aims stated by the S.P.E.E. Committee on Engineering Education After the War but also a general feeling that these aims were too elaborate for accomplishment in approximately one fifth of a four-year undergraduate curriculum.

Several sequences of humanistic-social courses in operation or proposed at other engineering schools were next considered, in particular those at Carnegie Tech and at Kansas State College. Various proposals for organizing the cultural content of curricula at Northeastern were introduced and carefully examined. There was considerable discussion as to the value of many of the proposed courses to an engineering graduate. It was emphasized that cultural training must be something more than just a series of subjects studied abstractly. Students are reluctant to admit any benefit from a series of social studies as they are chiefly concerned with technical knowledge, thus a high degree of perfection in teaching these courses is necessary in order to get fullest benefit.

The concensus of the branch seemed to be that curricula in engineering at Northeastern should provide a sound professional training with minor attention to the liberal arts and social sciences. Those who achieve the B.S. degree on this plan and who desire to build careers in the highly technical aspects of engineering will need to go on to one or more years of graduate study. The Northeastern curricula should prepare adequately for this. On the other hand most recipients of the B.S. at Northeastern will find immediate placement in industry or engineering on the basis of the curricula pursued as undergraduates. The Northeastern curricula should be designed to accomplish this purpose as well. Thus the programs would be neither general college education with emphasis on the physical sciences nor training exclusively technical and lacking in breadth and scope, but a compromise between these extremes and distinctly professional in character.

There was general agreement that this meeting of the branch had been extremely helpful in advancing faculty plans for post-war curricula at Northeastern.

ERNEST L. SPENCER,
Secretary.

College Notes

University of Detroit.—For the fourth time in seven years a student of the University of Detroit has won the Charles T. Main award, principal undergraduate prize of the American Society of Mechanical Engineers for college students in the United States and Canada. The winner is Fred Piaskowski, 20, senior mechanical engineering student. His paper was called "A Case Study of Management-Labor Cooperation in Influencing the Effectiveness and Efficiency of Production."

Rensselaer Polytechnic Institute.—Livingston W. Houston has been elected president of Rensselaer Polytechnic Institute, the country's oldest college of engineering and science, to succeed Dr. William Otis Hotchkiss, who retired a year ago last October.

Texas A. & M. College.—Howard W. Barlow has been elected Dean of the School of Engineering by the Board of Directors of the Agricultural and Mechanical College of Texas.

Dean Barlow graduated from Purdue University with the degree of B.S., M.E. in 1927 and holds the degrees of M.S. (Minnesota 1934) and Eng.Sc.D. (New York University 1941). At the time of election to Dean of Engineering, he had been serving as Acting Dean of Engineering since June 1944, and prior to that he was Head of the Department of Aeronautical Engineering. He joined the staff at the A. & M. College in 1940, coming from the Aeronautical Engineering Department at the University of Minnesota.

Dean Barlow's background includes 12 years of teaching aeronautical engineering, extensive consulting engineering practice, and the position as staff engineer for the Glenn L. Martin Co. As far as it is known, he is the only aeronautical engineer holding a deanship in a major institution of higher learning.

Texas Technological College.—President William M. Whyburn assumed his duties as President of Texas Technological College on September 11, 1944, succeeding President Clifford B. Jones. Dr. Whyburn holds the Bachelor's, Master's, and Doctor's degrees from the University of Texas where he majored in Mathematics and minored in Chemistry. At the time of his appointment to the Presidency he was Chairman of the Mathematics Department at U. C. L. A.

President Clifford B. Jones, who resigned because of ill health, has been made President Emeritus. He has been associated with the College since 1923. From 1923 to 1939 he was a member of the Board of Directors and Chairman of the Board. In 1939 he

was made President. Friends of the College all appreciate his long and unselfish devotion to the best interests of this institution.

Practically the full Engineering program is being maintained this year, even though the enrollment is somewhat smaller than last year. The Engineering staff has been reduced by eight regular faculty members over last year, five of whom went into the armed forces. The E.S.M.W.T. Program is being carried forward, but on a smaller scale than last year. There are no programs for the armed forces being conducted by the College at this time, the last terminating on September 30, 1944.